

CÆSAREAN SECTION
LOWER SEGMENT OPERATION

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OPERATION

BY

C. McINTOSH MARSHALL, F.R.C.S.(Eng.)

Honorary Assistant Surgeon, Liverpool Maternity Hospital, etc

WITH 2 PLATES
AND 107 ILLUSTRATIONS

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PREFACE

THIS work deals with the *operative* aspect of intraperitoneal lower segment Cæsarean section—a procedure which, while still possessing a reasonable simplicity, presents the only truly strategical and really surgical approach to the cavity of the pregnant uterus

The book is founded on an extensive reading of the literature and a personal experience which now extends to two hundred and fifty operations. Throughout, all those points have been stressed, perhaps overstressed, which, it is hoped, will prove to be of real use and value to the beginner

I would not minimize the dangers of even this form of Cæsarean section. None the less many of them can be reduced and the operation stripped completely of others if the various problems of technique and anæsthesia are carefully weighed and considered. With these features the following pages are primarily concerned

Every effort has been made to make this study clear and attractive. To this end I have been fortunate in securing the collaboration of Mr Douglas J Kidd. The great majority of the illustrations are from his pencil, and in any success this work may achieve the reader will agree his share must be considerable

In illustrating the history of the operation and the technique and methods of contemporary practice, I have drawn freely from the published works and papers of others. Due acknowledgements have been made in the appropriate places

I was first moved to adopt the lower segment operation after reading the works of those pioneers—Munro Kerr in this country and J B DeLee in America—for whose inspiration I shall always feel grateful

Just over one hundred of my operations were performed during that period of a little more than three years when I acted as Resident Obstetric Assistant to the Liverpool Maternity Hospital. This splendid introduction to the study and practice of the lower segment operation was due entirely to the generous, always kindly, and encouraging attitude of the Honorary Surgeons of this Hospital, without which this small work could not have been undertaken

Therefore to Dr. J. Hayward Willett, now Consulting Surgeon, and to my colleagues, all my seniors on the Staff, I most gladly express my gratitude.

To my senior colleague, Miss Ruth Nicholson, I am particularly indebted for much of the interesting clinical and operative material which has come my way during the last four years.

I have received much help and support from my friend Mr. John Hamulton, Obstetric Assistant to the Liverpool Maternity Hospital, and would like to thank him here for his willingness, at all times, to give me the benefit of his personal views and conclusions, derived as they are from a considerable experience of the operation.

For their help at operations, for their willing assistance in moments of emergency, and for their studious care of patients during the puerperium, I cannot adequately express my thanks to all those Residents who have passed through the Liverpool Maternity Hospital in the last seven years.

Sisters and nurses have also played their part. I would specially mention Sister D. S. Gill, who for several years has been in charge of the Labour Ward and Theatre arrangements, and Sisters Lines and Marsh, who, in supervising the Isolation Ward, have been responsible for the after-care of most of the severely ill patients.

My thanks are due to Miss E. McMahon, who has typed the manuscript not once but many times, and has helped in abstracting innumerable references.

For his assistance in reading the proofs I am indebted to Mr. W. A. Lee, Librarian to the Liverpool Medical Institution.

The photographs of specimens were taken for me by Mr. J. M. Manby, senior laboratory technician in the Department of Obstetrics and Gynaecology, University of Liverpool.

To Messrs. John Wright and Sons Ltd. I would express my thanks for their courtesy and patience throughout the preparation of this work. Their kindly suggestions and constructive criticisms have done much to make this self-imposed task a real pleasure.

C. McI. MARSHALL

Liverpool,

Summer, 1939.

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CÆSAREAN SECTION: LOWER SEGMENT OPERATION

CHAPTER I HISTORICAL

"It cannot be denied that of the women who undergo Cæsarean Section more than two-thirds die, and barely a third are saved Cæsarean Section belongs to those operations of which the outcome is entirely uncertain Before, then, undertaking this procedure, one should allow the patient to draw up her will and grant her time to prepare herself for death" (OSIANDER)

FOR long after the time when Oslander wrote these words, Cæsarean section remained a desperate intervention When death did not ensue from immediate shock and hæmorrhage, it was almost certain to follow within a few days from peritonitis or general infection But if such deadly results were disheartening they served at least to direct attention ever more closely to the many problems of the operation One of these, which we recognize to day as perhaps the most important, concerned the site and direction of the uterine incision There is, then, in Oslander's contribution an interest which has not diminished with advances in knowledge or the passage of years He says —

Friedrich Benjamin Oslander 1759-1822 "There still remains another type of incision, devised by myself, which opens the uterus in its lower half, and through which, with less danger, the delivery of the child may quickly be brought about I have already in 1805 delivered one patient by this method and again, in 1806, delivered another Its advantages are —

"a The incision falls in the lower part of the uterus wherein, as experience has often shown, ruptures are not so dangerous as when they occur in the upper or middle divisions of this organ

"b The incision may be made about two inches shorter than the one usually employed The head, lying in the upper part of the pelvis, can then be pushed through an opening in the uterus four or at the most five inches long The body and afterbirth are easily expelled by the natural powers When, on the contrary, the uterus is exposed through the usual incision in the *linea alba* or to one side of it, a uterine incision of 6 in. will be required for the extraction of the child

"c. When the empty uterus retracts and sinks down into the pelvis the wound is hidden behind the symphysis pubis. Prolapse of omentum or bowel into the womb can then occur only with difficulty, while through the neighbouring abdominal incision discharges of blood and liquor amnii will find a ready exit.

"Although neither patient survived in whom I employed this operation, the experienced and discriminating will readily appreciate that the fatalities cannot be ascribed to the operative course pursued, but must be attributed to the poor general condition of the subjects. When, therefore, the width of the pelvis will permit the entry of a hand, and the fœtus presents by the head, this method will prove itself superior to the older procedures."

Born in 1759, Oslander received his earlier medical education in Tübingen, and later studied under Fried in Strassburg, and Stein in Kassel. In 1792, at that time engaged in general practice in a small town in Würtemberg, he was appointed Professor of Obstetrics and Director of the newly erected Maternity Hospital in Göttingen. Here he laboured until the year of his death in 1822. His attitude towards obstetrics, aptly expressed in the title of his work—*Entbindungskunst*—would receive little acceptance to-day. Of the 2054 deliveries which took place in his clinic during these thirty years, forty per cent were accomplished by forceps and six per cent by other artificial means—the "Hebel", version, and Cæsarean section. Craniotomy he abhorred, having resorted to it only once, and that during the period when he was engaged in practice. It is to be feared, however, that with the forceps he not infrequently attained the same end. He prepared and preserved the skulls of all infants who failed to survive instrumental delivery. Many of these can still be seen by the visitor to Göttingen—a perpetual witness, at least, to his surgical honesty and uprightness of character. His selection of the lower uterine segment—"im unteren Teil der Gebärmutter"—is even more interesting when it is remembered that Röderer, one of his predecessors in the same chair, was the first to introduce this descriptive term into obstetrics (Martius).

The description of his first Cæsarean section occupies several pages of his book and affords a fascinating insight into the mentality of the man himself, and an illuminating picture of the obstetric conditions prevailing in his day.

The patient, a rickety dwarf about 30 years of age, was admitted to the Institute on March 15, 1805. She was 4 ft. 2 in. in height.

Her condition was pitiable, she was hungry, miserable, and emaciated, her skin covered with scabies, and she was suffering from a profuse leucorrhœal discharge. The pregnancy was within a few weeks of term, and the true conjugate was less than $2\frac{1}{2}$ in. This fact Oslander was able to demonstrate to a succession of students on the actual parts, which, for many years he kept preserved in spirit.

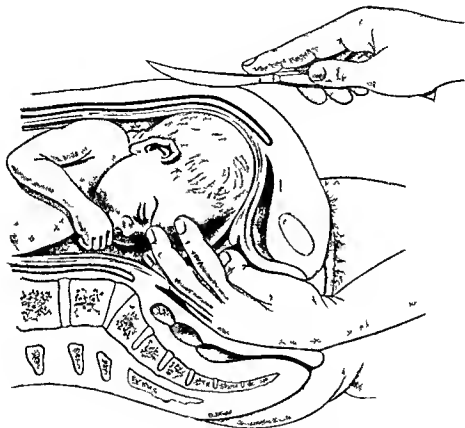


Fig 1—Oslander's operation (After DeLee)

Labour began on March 20, a day on which three difficult deliveries had already been undertaken in the clinic. In the presence of the students, the more experienced of whom he allowed to make an examination, the pelvic measurements were repeated. The cervix was found dilated to about four fingers, and the liquor amni had all drained away. Oslander convinced himself that version was out of the question as the pelvic brim was too narrow to admit the whole hand and enable him to secure a foot. One of his pupils proposed

that with his smaller hand and wrist he might possibly be able to reach higher, and begged permission to make the attempt. His manipulations were attended with no success. Delivery by Cæsaean section was then decided upon, and Osiander retired to rest for half an hour to prepare himself for the task.

The operation was carried out in the following way :—

“ The patient was placed horizontally on the special delivery couch, over which had been laid a sheet and an abdominal binder. Sitting between her legs I passed my left hand into the vagina, clasped the face in my palm, and pushed the head forwards against the left rectus muscle. Then, after marking out a length of four inches and using the convex knife of Stein, I exposed the uterus at the third stroke. I now made a small incision through the uterine wall on to the head, and this I enlarged upwards and downwards with Stein’s concave knife. Bleeding was very slight. The head escaped from my hand through the wound, and the body followed so rapidly that my assistant was only just quick enough to catch it. I had intended to remove the placenta with the hand, but while Dr. Delius was tying and dividing the cord it quickly escaped with the membranes through the incision, and I had to withdraw my left hand from the rapidly retracting uterus. The child was very feeble and was placed in a warm bath. As soon as my hand was withdrawn the womb sank deeply into the pelvis. My assistant endeavoured to prevent the exit of omentum and bowel with towels soaked in warm oil, but this was not entirely successful owing to the talkativeness of the woman. However, we had not heard from her the slightest cry during the making of the incision. The bowel was returned with considerable difficulty and the edges of the abdominal wound united with four sutures, the needle including in its passage the whole thickness of the wall. Thereafter she was put to bed, and appeared considerably brighter than many who have undergone a difficult delivery through the natural passages.”

The woman died at twenty minutes past two on the morning of March 22, and autopsy showed that death was due to early peritonitis. Taking into consideration all the features of the case, we can have little doubt that Osiander fully realized his primary aim—the delivery of the infant through an incision in the lower segment. We are left wondering what the outcome might have been had the uterine incision been carefully sutured.

Osiander first embodied these experiences in a paper which he read before the Royal Society of Science in Göttingen in 1812, though it is not unlikely that long before this (as DeLee has suggested) his teaching in these matters was known beyond the immediate circle of

his associates Possibly, however, it was no more than mere coincidence which caused Jorg, of Leipzig, to write in 1806 —

J C. G Jorg “The vagina is occasionally ruptured in difficult and
1779-1856 tedious labours, and the child generally escapes through the
tear into the peritoneal cavity Would it not be possible
in performing Cæsarean section to open the vagina, and, where this
was not sufficient, to extend the incision into the uterus? Presumably

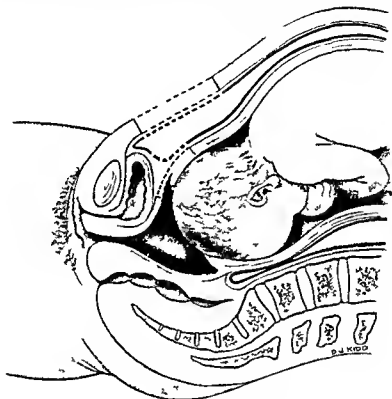


Fig 2 —Jorg's proposed operation

by this alteration in the technique, the operation would become safer than it is when the uterus is incised in its middle part It was only a short time ago that I lighted upon this idea and have therefore had no opportunity to test its value But I would ask obstetricians to bear this in mind and to test the truth of my proposition should they ever have the chance of sectioning a woman who has died in the later months of pregnancy ”

And again in 1807 —

“I will take this opportunity to remind obstetricians of executing Cæsarean section by a method which has been described by me

elsewhere. After opening the abdominal cavity the vagina is incised, and, when necessary, the cervix as well. Many cases have been reported in which the child has been expelled into the abdomen through tears which have arisen in the vagina. Such occurrences support me in my contention that this would be a possible procedure."

Jörg was appointed in 1810 to the charge of the new Maternity Hospital in Leipzig. For the first time in this city practical instruction was now made available for both pupil midwives and students of medicine. An earlier association with Menz had brought him partly into line with the Osiander tradition, but after a period of six months spent in Vienna he returned to Leipzig strongly imbued with the spirit of the more conservative Boër. Henceforth, like many other obstetricians of his day, he found himself in conflict with the radical practices of the Göttingen School.

He wrote several works on his subject and in one of them in 1820, he reverts to the question of Cæsarean section:—

"Only once have I had the opportunity—and this on a dead woman—to perform the operation in this manner. In this instance I was able to see that it was a perfectly easy matter to deliver the child when the incision was placed in the lower part of the uterus (an seinem unteren Theile). Is it not possible that the incision in the lower segment (am untern Segmente) of the uterus may be fraught with less danger, and further, that healing may occur more readily, than when the uterus is opened in its middle portion?"

Ferdinand
Ritgen
1787-1867

The surgical course pursued by Osiander and the procedure recommended by Jörg, both involved opening of the peritoneal cavity. During this period, the first quarter of last century, the general surgeon opened the abdominal cavity only under the greatest compulsion and then with the most gloomy forebodings, for peritonitis was almost the inevitable result of such temerity. Necessity, then, gave rise to the extraperitoneal route. The first to appreciate that through such an approach the vaginal wall (and the lower segment?) could be displayed, was Ferdinand Ritgen, for fifty-three years Director of the Obstetric Clinic in Giessen. His own directions for the operation which he named "*Bauchscheidenschnitt*" can be briefly summarized: The surgeon stands on the right of the patient. A male catheter is passed and with this directed properly the bladder is beld over to the left! An assistant draws the fundus uteri over to the mother's left side. The extraperitoneal tissues are reached by a right-sided abdominal

incision placed just above Poupart's ligament. With blunt finger dissection the vaginal wall is then exposed in the depths of the wound. A guarded sound is passed into the vagina and the right lateral fornix is pierced. From this small opening the incision is enlarged first downwards and forwards, and then backwards and upwards. If there is not sufficient room for delivery to take place the incision may be prolonged into the lower segment. The uterus is still held strongly over to the left, the wound is packed with gauze, and the exit of the child is awaited. The operation should not be performed until the cervix is almost fully dilated.

An opportunity presented itself on October 1, 1821. His patient was 37 years of age, and the mother of three children. Since the birth of her last child, two years previously, she had fallen a victim to osteomalacia, and at the time of operation was in an extremely weak state, was bedridden, and presented the deformities characteristic of an advanced state of that disease.

"I betook myself immediately to the house of the patient, where we found present a sufficient number of assistants. The patient's condition was just as Dr. — had described. She was extremely emaciated, her pulse was small and rather rapid, but there was no fever. Her sole care was that the child should be saved, and she complained only of a feeling of great exhaustion. The pains had begun early on the previous day, but in the evening had passed off, to reappear again in the night, and increase in intensity towards five o'clock in the morning. From this time on the pains recurred at intervals of from five to eight minutes. The cervix felt soft and œdematous and the dilatation of the os was about $2\frac{1}{2}$ in. in diameter.

I wished to defer the operation until the cervix was fully dilated so that after making the incision the infant might be rapidly delivered. But on account of the weakness of the woman, it would have been too risky to wait any longer. She was therefore brought to operation at 10 a.m., after rectum and bladder had been emptied and a dose of morphia had been given. The preparations detailed above were carried out and the necessary instruments assembled. The skin was incised on the right side and the muscles divided in the line of the incision. Bleeding vessels were ligated.

"The vaginal wall was exposed on its right side, the cellular tissue being readily separated by finger dissection. I passed the wooden stem of my pelvimeter into the vagina, pressed the end of this instrument against the vaginal fornix, and elevated the latter over the angulated region of the pubic bone. The first assistant now controlled the pelvimeter while I incised the vagina on to the end of its projecting stem and then with the bistoury increased the incision for a length of $1\frac{1}{2}$ in. towards the urethra. Bleeding was slight and ceased

spontaneously. I now extended the incision backwards for one and a half inches. I had not quite completed this step when the wound suddenly filled with blood. I succeeded in controlling the hæmorrhage by pressure with a sponge wrung out in cold water ; and I now waited till a pain occurred. The child did not perceptibly advance, and, indeed, the pains were weaker than they had been earlier on. I determined that with the next pain I would divide the cervix and draw

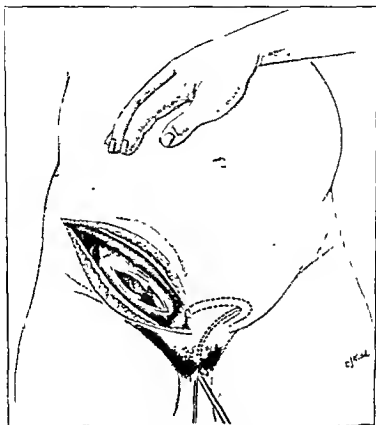


Fig. 3.—Rutgen's operation.

forth the head ; but the moment I withdrew the sponge the bleeding recurred so profusely that it had to be replaced and this idea abandoned. We now decided to leave the delivery to nature if possible, the bleeding being perfectly controlled by the sponge. Half an hour thus passed, the patient's strength meanwhile being sustained, and the pains encouraged with spirits, cinnamon drops, and the like. The womb, however, remained relaxed, and the patient began to fail. It was then obviously a question of attempting to save the child which still showed signs of life. . . . While we were discussing the means to be adopted

her condition further deteriorated I examined vaginally but found no collection of blood in the passage. As she momentarily rallied I quickly seized a knife and performed the usual type of Cæsarean section in the way recommended by Stein. In a few moments I had extracted a sturdy male infant vigorous and full of life."

His patient died

Two somewhat similar operations were performed by Baudelocque (the nephew) in 1823. One of these was an intraperitoneal operation. Both women succumbed—one to peritonitis, the other to hæmorrhage. To this type of operation the famous French accoucheur gave the name of 'gastro-chrotomy.

In 1824, three years after Ritgen's unlucky effort, a further contribution was to be made to the history of the lower segment operation—this time from the other side of the Atlantic through the medium of a letter from a Professor of Anatomy to W. P. Dewees, Professor of Obstetrics, University of Philadelphia, who was then on the point of publishing his *Compendious System of Midwifery*. As Dewees himself explains in his book, "the importance of its contents will amply apologise for its introduction"

"My dear Sir,

"The Cæsarean Operation as commonly performed, puts into such danger the life of the mother, that it is still a desideratum to ascertain some modifications of it, which may diminish its fatality, and thereby inspire the profession with more confidence and promptness in undertaking it. Several changes in it have been proposed from the time of its first adoption, principally with a view to avoid the chances of wounding the urinary bladder, or of cutting through the large vessels, which, in a state of pregnancy, occupy the broad ligaments of the uterus. In their principle they differ immaterially from each other, as they all involve the necessity of cutting into the cavity of the peritoneum, on which circumstance, it is generally conceded, the great danger of the operation depends.

"This operation has been a frequent subject of conversations which I have held with our common friend, Dr. Physick, and I have been as often instructed by the views which he has taken of it. More than two years ago, it being then a matter of particular inquiry with me, I was struck by the following proposition of his in regard to it, which made a very strong impression on me, and the justness of which I have ever since been extremely anxious to verify by dissection. It is well known to anatomists, that but a very small portion of the upper anterior part of the vagina, in the unimpregnated state, is covered by the

peritoneum, and that the portion of peritoneum which lies upon the fore part of the cervix uteri and vagina, is connected to them by a long, loose, cellular tissue, which allows the peritoneum in the distensions of the urinary bladder, to be separated still further up from the vagina.

"It has not been equally remarked, that this peritoneal covering of the vagina is of a very fugitive character, and that if the moderate distensions of the bladder be much increased, the peritoneum even leaves the anterior face of the cervix uteri, and its reflexion to the bladder departs thence at the lower part of the body itself of the uterus.

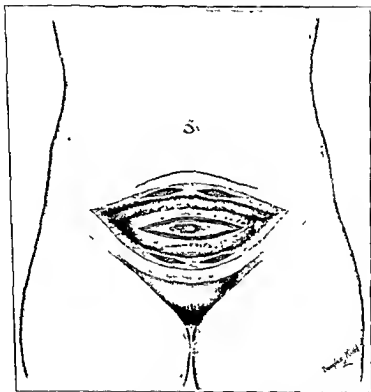


Fig. 4.—Phrask's proposed operation.

"By a fortunate coincidence, I have at this moment under my observation, these parts about the end of the sixth month of pregnancy, the fœtus having been just expelled from the uterus, with its head remaining in the vagina, owing to a breech presentation. It may be mentioned in passing, that there is good reason to believe that the uterus here took on the parturient action, after the other phenomena of life had ceased. In this case I find the peritoneum drawn off from the vagina by a common distension of the bladder. And by my drawing moderately at the bladder the peritoneum leaves the cervix uteri after the same manner that it does in the unimpregnated state.

"Dr Physick, founding his ideas upon a similar observation made in early life, during the dissection of a pregnant woman, proposes that in the Cæsarean operation a horizontal section be made of the parietes of the abdomen just above the pubes, and that the peritoneum be stripped from the upper fundus of the bladder by dissecting through the connecting cellular substance, which will bring the operation to that portion of the cervix uteri where the peritoneum goes to the bladder. The incision being continued through this portion of the uterus will open its cavity with sufficient freedom for the extraction of the fœtus, all of which the doctor supposes may be done by a careful operation without cutting through the peritoneum.

"It is evident that if this be a practicable operation it will diminish immensely the tendency to peritoneal inflammation, and will, in fact put it on a foundation of danger very closely allied to the taking up of the external iliac artery, near its origin by turning aside the peritoneum, an operation the success of which is sufficient to justify any competent person in undertaking it.

"Knowing the value which you, as well as myself, put upon the suggestions of a person whose mind is so remarkable for its professional sagacity and resources, I have thought that even a proposition not yet confirmed by actual experience of its success would not be an unacceptable addition to the fund of information you are about to communicate to the public.

"I remain, very sincerely, your friend,

"W E HORNER"

"To Doctor Dewees

Sept 28, 1824

"Dr Physick proposes that the operation be performed with a moderately distended bladder, and that a catheter should be introduced previously, to ascertain its situation."

Neither Physick nor Dewees ever practised this operation.

Thus, even before the first quarter of the century had quite run out, these early pioneers, working independently and widely apart, were seriously engaged upon one of the gravest obstetrical problems of the period. Some contributed only in theory, others acted with courage and decision. Their efforts have been followed in some detail, for in one or another we can already discern most of those principles on which our present day methods are so firmly grounded. Yet the citadel of success was not to be stormed by such sporadic and unsupported sallies. Advances in anatomical and pathological knowledge were undoubtedly followed by minor improvements in surgical technique. But surgeons still neglected to close the uterine incision. Anæsthesia had not appeared. The results of infection were recognizable but its cause remained a mystery. Indeed, the mounting years

of the century were to claim a heavy toll of mothers while knowledge lingered far behind. The outlook, however, was not discouraging. In 1825 Louis Pasteur was already a child of three. Ignaz Semmelweis was four years his senior. Joseph Lister was born at Upton, in Essex, on April 5, 1827.

The ensuing three decades were unproductive of any significant improvement in the technique or results of Cæsarean section. Of 40 patients operated on in Paris between 1800 and 1850 not one survived (Fehling). In Vienna the results were no better: "It made a deep and lasting impression on my mind when Friedrich Schauta, speaking with considerable emotion, told us students in 1911 that he personally had assisted his teacher Späth, Karl Braun, and others, in the summer of 1877, at a Cæsarean section operation. This was the first, since the foundation of the hospital, to turn out happily for the mother. He operated according to the method of Porro" (Kahr).

Gastro-elytrotomy had seemingly been forgotten. True, in 1857, an Italian professor (Francesco Cianflone) had attempted a modified Baudelocque-Ritgen operation (Nürnberg). The lower segment was reached—but only after traversing both anterior and posterior walls of the bladder! It was not until 1870 that Ritgen's operation was once again brought to light by T. G. Thomas, Professor of Obstetrics in the College of Physicians and Surgeons of New York: "I discovered that the idea was an old one and that what I supposed had originated with me, had years ago been tested and thrown aside."

T. Gaillard
Thomas
1831-1903

Thomas won for himself considerable distinction as a gynæcologist—a fact which has tended to obscure his obstetric activities. His eloquent lectures, models of medical oratory, attracted even busy colleagues to take their places along with the students in his overcrowded lecture room.

He first practised the operation on the cadaver: "It was the remark of all present, that had the child been alive at the commencement of the operation, no influence was developed during its performance, which could have injured it." A month later he was called to a woman who was dying of pneumonia. "The patient, a multipara aged about 40 years, and at the end of the 7th month of utero-gestation, had been suffering from pneumonia for a week or ten days, and was now in articulo mortis."

"The patient being placed upon the table, anæsthesia was produced, so as to quiet her restlessness and jactitation, with a few inhalations of ether. I then passed my hand up the vagina and dilated

the cervix slowly and cautiously so that at a threequarter distension no injury was done to its tissue. With bistoury I then cut through the abdominal muscles, the incision being carried from the spine of the pubis to the anterior superior spinous process of the ilium. The lips of the wound were now separated and by two fingers the peritoneum was lifted with great readiness, so that the vagino-uterine junction was reached. The vagina was now lifted by a steel sound passed within it, and cut, and the opening thus made was enlarged by the fingers. The cervix was then lifted into the right iliac fossa by the blunt hook, while the fundus was depressed in an opposite direction. I then passed my right hand into the iliac fossa and introduced two fingers into the uterus, while the left hand placed on the outer surface of the uterus, depressed the pelvic extremity of the foetal ovoid. The knee was readily seized, and the delivery easily and rapidly accomplished. The child was born alive, but was a badly developed hare-lipped, and as I before stated, premature infant. It lived about one hour, during which time the rite of baptism was administered to it. The mother, the wound in whose abdomen was closed by interrupted suture, died about the same time as the child.

Thomas performed the operation once again. This time mother and child survived. The bladder was wounded but the fistula closed spontaneously. Skene, a well known obstetrician, practising in Brooklyn, used the same procedure on three occasions, twice with happy results, while Gillette, also in America, was rewarded with success in the only case in which he employed it.

The distinction of being the first to perform 'laparo elytrotomy' in England fell to Whiteside Hime of Sheffield. This he did on Sunday, July 14, 1878.

He was summoned by one of the midwives attached to the Hospital for Women to visit Mrs. O'M, who had been in labour for over twenty hours without any advance of the child. Labour was obstructed by a large cancerous mass in the rectovaginal septum.

"Having then just read the very interesting paper by Dr. F. Gaillard Thomas, of New York, on laparo elytrotomy, I determined to try it, as the state of the woman was so grave that Cesarean section would evidently cause instant death. With the exception of the spray I employed antiseptic measures. The patient having been placed on the operating table and chloroformed, I made an incision through the abdominal wall in the direction of a line extending from the left anterior superior spine to the spina pubis. After a little difficulty in distinguishing a layer of fat which simulated the appearance of the omentum, the peritoneum was reached and readily recognized, being much more ample than in non-pregnant women, and hanging in folds at the bottom of the wound. I next passed a blunt probe up the vagina, and by it

pushed the anterior vaginal cul-de-sac into the wound. Seizing this with a pair of hooked forceps, I divided it, and, passing my finger through the orifice, felt the os uteri. Some slight difficulty was experienced at this part alone of the operation owing to the small space which existed between the anterior surface of the enlarged uterus and the brim of the pelvis. Having extended the wound, I passed my hand through it into the fully-dilated os, which was occupied by the head and bag of waters. I at once seized a foot and turned and delivered a living male child without the least difficulty, the placenta being delivered simultaneously. The uterus contracted rapidly, and there was no uterine hæmorrhage. There was not over an ounce of blood lost in the operation, a couple of small arteries, which were divided in the incision, having been at once secured by torsion. In fact few ordinary labours are completed with less loss of blood. The operation lasted a little over 20 minutes. The wound was washed with carbolic lotion (5 per 100) and closed with gut sutures, and antiseptic dressings applied. The patient was then put to bed with hot bottles, etc."

Death occurred shortly afterwards.

In November of the same year Arthur W. Edis of London performed the only other operation of the same type in England. Two attempts had been made to deliver the woman with the long forceps. Edis "observed every antiseptic precaution". Death followed 40 hours later. "It is unfortunate that the first two cases recorded as having been performed in Europe have ended fatally; but this should not deter us from studying the details of the operation more carefully, and giving it a fair trial when opportunity occurs" (Edis).

Within the ten years 1870-1880, eight gastro-elytrotomies were performed, 6 in America, 2 in England. Four mothers died, a maternal mortality of 50 per cent. But even if other influences had not been at work, it is doubtful if the operation ever really had a future. The danger of uncontrollable hæmorrhage was always present. In five out of eight cases the bladder or ureter was wounded. Extraction of the child seemed to present special difficulties. The cranioclast was employed twice (once on the dead child). Thomas delivered his first patient by version, Edis his only one with forceps. These difficulties might for the most part have been disregarded had the operation appeared to promise any marked superiority over the 'classical' procedures. This was not the case. The total number of collected cases, 14 in all, showed a maternal mortality of 50 per cent (Küstner).

MODERN PERIOD

Towards the latter part of 1847 chloroform and ether were finding their way into most of the large clinics of Europe and America. In 1848 the teachings of Semmelweis were already bearing their first fruits in the First Obstetric Division of the great Viennese hospital the total maternal mortality during that year had hardly been more than one per cent. Haller, provisional Director of the Hospital, drew special attention in his annual report to the greatly improved results which had attended the adoption of the special measures recommended by Semmelweis. "Their significance for Maternity Institutes, Hospitals, and above all for surgical departments, is immeasurable and deserves the earnest attention of all men of science. They will certainly not pass unrecognized by State and municipal authorities." But the story is well known. Sitting within its very shadow, men failed to perceive the closeness of truth. Kolletschka had apparently died in vain, and another twenty years were to pass. In 1867, Lister published to a more receptive profession his method of carbolic sterilization. Few great medical discoveries have so rapidly undergone such a radical change in practice, while remaining essentially the same in principle. It was only a step from antiseptics to asepsis, from the chemical used at close quarters to physical sterilization applied at a distance. But it must not be imagined that it was taken in a day. Robert Koch, Pasteur, and others had still their roles to play. At first regarded as infallible Lister's system had its weaknesses, and these were gradually exposed. Not, in fact, until the last few years of the century did patient and surgeon begin to meet regularly under complete aseptic safeguards.

Nevertheless, from 1870 onwards, the danger which came from without was less to be feared. It was the menace that lurked within with which abdominal surgeons had still to contend, and in few intraperitoneal procedures was this threat greater than in the operation of Cæsarean section. There was as to day, no known means by which the vulva, the vagina, the cervical contents, or the uterine contents could be rendered bacteria free, and so long as the lochial discharge could find its way into the peritoneal cavity there was little hope of any great improvement. Porro of Pavia was to offer a temporary, if only partial, solution to this problem.

Porro

His patient was a rickety primigravida 25 years of age.

The true conjugate was 4 cm. Operating in the lecture room of his clinic he delivered her by Cæsarean section on May 21, 1876.

Originally intending to suture the uterus, he was compelled to change his plan when sudden and threatening hæmorrhage occurred after the delivery of the infant. The uterus was rapidly amputated, the stump of the cervix fixed in the abdominal wound, and the abdomen drained. Giulia Gavallini and her child left hospital well thirty-nine days later, the first mother to survive the operation in that clinic (Alfieri).

Such a success was bound to impress, and men were not slow to appreciate the grounds on which it rested. It seemed for a time as though the Porro operation would, despite its unattractive features, find some favour with the profession. But the 'classical' operation was just then on the threshold of its future. Within a few years of Porro's publication its steps were to be improved out of all recognition, and its results bettered beyond all comparison with those of the past.

Two men did more than any others to retrieve Cæsarean section from the disrepute into which it had fallen. F. A. Kehrer and Max Sänger, in 1881 and 1882, were the first to appreciate clearly that many of the bad results of Cæsarean section were due either to the absence of any attempt to close the uterine incision, or to the imperfect and unsatisfactory closures which, up till that time, had occasionally been attempted. Sänger's work is well known. The part that Kehrer played in the development of the uterine suture has frequently been overlooked. Their publications on the subject appeared almost simultaneously. With regard to priority in its first practical application in Cæsarean section, the honour is undoubtedly Kehrer's.

His publication possesses an additional distinction—it opens a further chapter in the story of the lower segment incision. He devised an operation of which the chief points were:—

- | | |
|---|--|
| Ferdinand
Adolf
Kehrer
1837-1914 | 1. Transverse division of the anterior uterine wall at the level of the internal os.
2. Closure of the incision by a "Doppelnäht"—the muscle first and the peritoneum separately after undermining the edges of the latter from the subjacent muscle. |
|---|--|

A wound so placed, he said, would have little tendency to gape, and the peritoneal suture line, being independent of the retracting muscle, would heal at rest. He put these considerations to the test of experience in the autumn of 1881. His first patient, the wife of a joiner, was suffering from osteomalacia and had been in labour for nearly thirty hours before the operation was undertaken.

"Preliminary preparations were then made. Two hanging lamps, one stand lamp, and several candlesticks were assembled,

a small table made ready with a stool at the end of it to support the legs, the instruments laid out in carbolic water, and the hand spray fitted up. Chloroform was administered and the patient brought to the table. The genitalia were shaved, the abdominal wall and thighs washed with carbolic solution, the vagina douched and then packed with a swab wrung out of the same lotion.

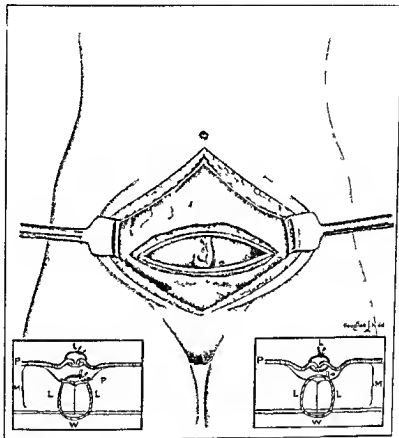


Fig 5 -- Kehrer's operation. Insets show the method of suture.

"The abdominal wall was incised in the linea alba below the umbilicus. The uterine wall was divided a little above the floor of the uterovesical pouch, the infant's left ear then presenting in the wound. The latter was now enlarged laterally as far as the round ligaments on either side. The head was delivered by applying the fingers of both hands as one would use the forceps. The placenta was extracted by drawing on the cord."

The method of closure differed in slight detail from that employed in his second patient who died. Six interrupted silk ligatures were used to effect the union of the muscle, and twelve to unite the overlying peritoneum. For the latter purpose he later advocated a continuous suture. Mother and infant survived.

The significance of his lower segment incision has often been overlooked. As regards its direction, and from his description of the level at which it was placed, it differs in no material respect from that employed (and illustrated) some forty years later by modern operators such as Munro Kerr, Hendry, Doerfler, Phaneuf, Wodon, Jullien, and others. While his technique aroused little interest at the time, or indeed for many years, it deserves to be regarded as *the most eminent landmark in the history of intraperitoneal lower segment methods*. Speaking in 1929, with the fullest knowledge of its subsequent developments, his son* was able to say: "The birthplace of abdominal Cæsarean section is a lowly cottage in the village of Meckesheim, near Heidelberg, and its birthday is the 25th of September, 1881."

We may digress for a moment to recall that Adolph Kehrer had an early association with Ritgen and the Giessen School. He had aspired once to become Assistant to Ritgen. This hope was not realized. He did, however, become Extraordinarius to his successor, Birnbaum. In 1880 he accepted a call to Heidelberg. Here he remained for twenty-two years, breaking new ground in many fields of obstetric science, and winning for himself a name that is still honoured and respected far beyond the borders of his own country. His example was an inspiration to a younger group of men, some of whom by their own accomplishments were to reflect the fame of the master. One of these was Fritz Frank of Köln.

But if our modern operation was born in 1881, the year 1882 saw the rebirth of the older procedure. "The waves set in motion by Ritgen's gastro-elytrotomy were overwhelmed and lost in the mighty rollers thrown up by the operation of Säger" (Nürnberger). First one suture material, then another, was adopted or discarded. The question of the suture line itself, and the exact layers to be included, was argued and discussed in almost fractional terms. New incisions were planned and practised. Corporeal incisions were made both high and low. The fundus was opened, by some transversely, by

* Professor E. Kehrer, Director of the Universitäts Frauenklinik, Marburg.

others longitudinally. The child was ever delivered through the posterior wall of the uterus. Almost every site was tested for its own peculiar advantages—except the lower segment.

Nor were the technical details of the operation the only object of consideration. The age of 'absolute indications' was past. With its greatly increased safety Cæsarean section gradually began to enjoy a much wider sphere of application. And this extension of its use was not unjustified, for between 1890 and 1900 the mortality of the operation had fallen, in a few clinics, to as low as 5 per cent. Even this figure was improved upon by individual operators. But if there seemed reason for complacency, this was neither real nor well founded. Such a low mortality only served to veil the truth. A successful outcome depended largely on one factor—the sterility of the uterine cavity at the time of operation. The 'suspect' and 'infected' cases furnished the majority of deaths, and these were due in the main to peritoneal infection. Zweifel could, for example, record 76 Cæsarean sections during this period with one death, this occurred from peritonitis in the only patient of his series who was 'infected' at the time of intervention (Braun-Fernwald). The classical operation then, as now, was a perfectly safe measure when applied only to those cases which were above all suspicion of infection. So there remained a group of cases which, despite the manifold improvements of the operation, could not be safely brought within its scope. Perforation of the living child, high forceps delivery which was often little better, difficult extraction after dangerous version, pubiotomy and symphysiotomy—recourse to such was only too frequent, and sheltering behind the high fœtal mortality of those procedures Cæsarean section went from success to success.

But considerations so grave could not for long remain ignored or be lightly brushed aside. Frank had himself as early as 1881 been engaged on the problem of how the uterine wound and the dangers which lay behind it could best be excluded from the peritoneal cavity. To this end he made his uterine incision longitudinally, beginning it in the uterovesical pouch. Finally the upper parts of the round ligaments were brought together in front of the uterus and their lower portions were united to the abdominal wall. In this way the scar came to lie in a tent, shut off from the general peritoneal cavity. The operation with its very obvious disadvantages was not welcomed.

But some twenty-five years later he aroused an immediate Fritz Frank and widespread interest in his new method of "supra-
1856-1923 symphyseal delivery". "I hold my method to be an essential advance, for by proceeding in this way, the woman is spared much loss of blood, peritonitis is prevented, and the operator is permitted greater latitude with regard to the time when intervention is decided upon." Twelve out of the thirteen women whom he delivered in this way presented certain of those conditions (long labour, early rupture of membranes, signs of open infection, etc.) in the presence of which "according to our present conceptions

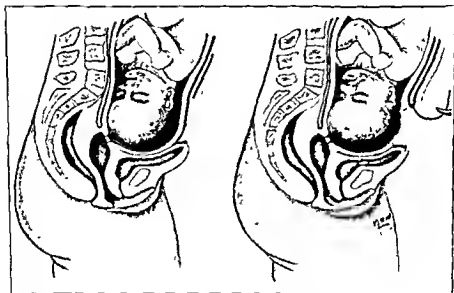


Fig 6—Frank's operation (Partly redrawn from Frank)

Cæsarean section should not have been performed" (Frank). All thirteen patients lived.

"The Trendelenburg position is adopted. The uterus is left in situ. Bleeding is remarkably slight and bowel is practically never seen in the field of operation.

"The abdominal incision is placed transversely immediately above the upper border of the pubic symphysis, the rectus muscles being divided a short distance above their insertions. The parietal peritoneum is divided in the same direction just above the bladder, which is retracted downwards and forwards. The uterovesical peritoneum is now split transversely half way between the level of its firm attachment to the lower segment and the point where it is reflected on to the

bladder. The upper edge of the parietal incision is pulled to the upper edge of the visceral peritoneal incision with a continuous suture of catgut. . . . The thinned-out lower segment is finally incised transversely, and through the opening, with the help of extra-abdominal pressure, the head is delivered."

The incision of the visceral peritoneum was extended laterally to include the anterior layers of the broad ligaments. Thus its angles nearly reached the extremities of the incision into the parietal peritoneum. After union had been effected by suturing, the zone of operation was rendered almost completely extraperitoneal.

Frank operated under chloroform anæsthesia. The uterus was closed with ligatures of catgut. The peritoneal suture was not removed. At the completion of delivery the uterine cavity was lightly packed with iodoform gauze, the end of which was either led out through the uterine and abdominal wound, or passed through the cervix into the vagina. It was usually removed between the second and fourth days. Though, on occasion, Frank attempted a true extraperitoneal operation, it does not appear that he ever actually succeeded. The method just described is the one which he illustrated and seemed to prefer. It is worth recalling that his ninth case was a patient with placenta prævia. Vaginal tamponade had previously been employed. At the time of operation she was extremely anæmic, and her pulse-rate was 140. Convalescence was perfectly smooth. *This appears to have been the first instance in which the lower segment route was used to deal with that condition.*

Frank's student days were spent in Giessen. Here he soon came under the notice of Kehrer, who appointed him to a junior teaching post in his own department. After a term as assistant to Bardenhauer, and while still a comparatively young man, he secured the Directorship of the Provincial School for Midwives in Köln. The appointment at the time evoked considerable criticism. In later years, however, the wisdom of the choice was fully acknowledged. Frank entered the obstetric field when there was still much to cultivate on the operative side. Symphysiotomy he also brought to a high degree of perfection, and his dexterity in this operation was the object of much admiration. But it is as one of the real founders of all our modern methods of Cæsarean section that he will chiefly be remembered.

The appearance of Frank's operation in 1906 was a decisive event in the history of Cæsarean section. The results he had achieved

were striking and impressive. Progress, for so long a matter of years, was now only a question of months. In one clinic and then another some fresh impetus or new turn was quickly given to the latest "suprasympphysial" operation. By 1912 the lower segment procedures as we know them to-day were not only widely accepted, but they had, in the hands of many obstetricians, already yielded the most satisfactory results. Naturally some measure of finality was not reached in one stride; it emerged only from a heterogeneous mass of modifications and variations. To consider all these in detail is no longer possible. We can, however, unravel from the tangle of literature certain principles which guided the trend of further progress.

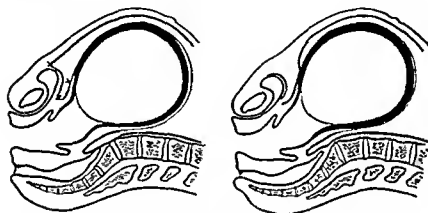


Fig 7.—Sellheim 11. Showing incision points in parietal and uterovesical peritoneum, level of excising suture, and line of access to lower segment. (Redrawn from Vogt)

A difference of opinion immediately arose as to the relative value of the two leading features of Frank's operation. Did its merit rest wholly on its 'extraperitoneal' nature, or did it lie rather in opening the uterus through the isthmus or cervix where the incision could heal at rest, and, by careful closure of the loose peritoneal covering, be readily excluded from the abdominal cavity? Viewed from another angle, importance was attached by some rather to 'the primary spill', or contamination of the peritoneum at the moment of operation. Others were not inclined to stress this so much as the later danger which might arise from leakage of infective material through the sutured uterine incision. Each of these points of view had, and still has, its adherents.

Hugo
Sellheim
1871-1933

In the subsequent development of the operation, Hugo Sellheim was an outstanding participator. His anatomical studies of the uterine peritoneum and the changes it underwent during pregnancy, labour and artificial distension of the bladder did much to simplify and improve the technique. In his first two operations he succeeded in holding to a true extraperitoneal course. The method (Sellheim I) differed in three essential particulars from the similar attempts by Frank: he substituted the Pfannenstiel for the Bardenheuer incision; instead of immediately trying to raise the uterovesical peritoneum from the bladder in the midline, he began laterally with blunt dissection and completed the separation medially with scissors; when the peritoneum



Fig. 8—Sellheim I (Pedraza from Vogt)

had been further raised and the bladder wiped downwards, the lower segment and cervix were incised vertically and as low as possible. He stressed the importance of this: 'I am not content, like Frank and Veit, to place my incisions simply in the region of the lower segment or the isthmus of Aschoff.'

In a third case his method of operating (Sellheim II) bore a close resemblance to Frank's artificial extraperitoneal operation. The parietal peritoneum was divided transversely just above the bladder and the upper edge of peritoneum was united by two continuous sutures to the anterior wall of the lower segment. The visceral peritoneum was then divided transversely in the depth of the uterovesical pouch and the cervix exposed after detaching the bladder. Sellheim III differed but slightly from the above. An upper flap

of the pre-segmental peritoneum was raised and its edge was sutured to the upper edge of the parietal incision. This procedure he practised in a large number of cases. In Sellheim IV we find an entirely new departure, devised to deal with the frankly infected case. "Utero-abdominal fistula" was, in his own words, "nothing more than an occasional makeshift—possibly the best—where, for example, in spite of the danger to the life and health of the mother, a child is

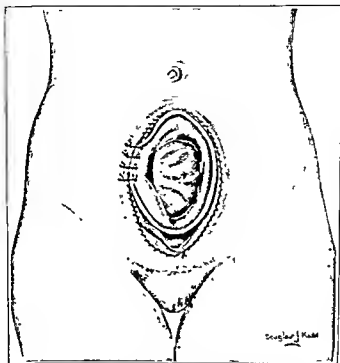


Fig 9—Sellheim's utero-abdominal fistula.

unconditionally desired, and it is fully recognized that the chance of further conception is very remote." In his aim to treat the uterine cavity like an open wound, the parietal peritoneum, the visceral membrane and the edges of the uterine incision were all sutured to the skin. If closure of the fistula did not occur spontaneously after the subsidence of infection, this was carried out by a second operation.

Meanwhile other operators were in search of greater simplicity. Rubeska recommended a low midline abdominal incision with suture of the edges of the parietal peritoneum to the front of the organ before the latter was opened. Fromme first incised the loose pre-segmental

peritoneum vertically, raised two or three inches, and sutured or clamped the edges of the incision to the abdominal wall. This is the operation of choice when the purity of the uterine contents is beyond doubt. But others were not impressed with the necessity for such fancy precautions. These and similar procedures were real intraperitoneal, however carefully the protective suture was carried out. And evidence was soon forthcoming that neither these artificial methods

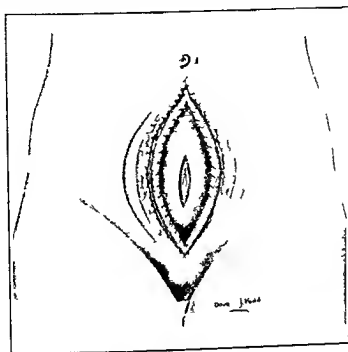


Fig. 10.—Vet Fromme's operation

nor even the true extraperitoneal operation offered definite immunity from peritonitis. Moreover the latter operation possessed certain disadvantages. It was unnecessarily difficult and complicated. Despite the greatest care on the part of the operator wounding of the peritoneum was not uncommon. The bladder was frequently opened. More rarely the ureter was divided. It must be remarked however that in the hands of Doderlein, Kustner, Latzko and others the extraperitoneal operation has since been simplified and brought to a high degree of perfection. But it is unlikely that it will ever be widely preferred to the intraperitoneal operation which is simpler and equally safe. (DeLee)

Pfannenstiel (1908), at the end of a paper in which he described an abortive attempt to perform an extra-peritoneal section, advocated an operation on the following lines. After opening the abdomen, the peritoneum in front of the cervix was to be divided in the same way as was done in performing subtotal hysterectomy, the bladder to be displaced if necessary, and the cervix to be opened longitudinally. This, or very similar intraperitoneal

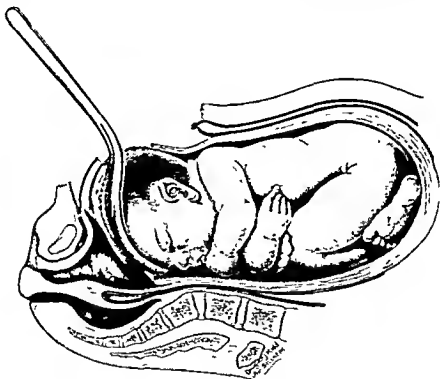


Fig. 11—Extraction of the head with the "Hebel".
(Redrawn from Sellheim.)

procedures, quickly became popular, and by 1912 several obstetricians were able to report their experiences in a considerable number of cases. Sellheim himself had by 1910 come to believe that the special merits of the newer Cæsarean operations lay less in the employment of an extra-peritoneal technique (natural or artificial) than in placing the uterine incision in the cervix. Henceforth he performed a purely intraperitoneal operation and dropped all peritoneal suture methods. It was now no longer necessary to

use the Pfannenstiël incision. The uterus and peritoneum are divided transversely, the abdominal cavity is closed by the incision and the peritoneal cavity protected from contamination by gauze packing. With these changes the technique of the operation was finally perfected (Vogt).

In 1909 Lewis collected from the German, Austrian and Russian literature the first 102 operations performed between that date and the announcement by Frank of his new technique at the International Congress of Medicine at Lisbon in 1906. Only 14 of these were purely transperitoneal. The maternal mortality was 8.8 per cent.

But at the Sixth International Congress of Obstetrics and Gynaecology in 1912 it was apparent that the lower segment operation was already fulfilling some of the early promise that had been claimed for it by Frank. Henkel of Jena reported that in 33 transperitoneal cervical operations he had lost only one mother, yet his patients were a representative group, his series included cases of intra-partum fever and patients in whom vaginal delivery had been attempted before admission to the clinic. Only in three instances were the membranes intact at the time of operation. In a few they had ruptured as long as four days before. Opitz in the same session reported 24 cases without a death, from the Giessen Clinic. When he felt that it was necessary, he passed his drain into the vagina through an incision made into the anterior fornix. The uterovesical peritoneum was then restored in the usual way.

Opitz held the operation to be preferable to the classical in all cases in which the operator could not be assured of the sterility of the birth canal. Had bacterial invasion of the uterine wall already occurred, success could not be looked for, but no more could it be expected from perforation. In such circumstances extirpation of the unopened uterus was a better procedure than the Porro operation or the utero abdominal fistula of Sellheim. Like the latter operator he preferred spinal anaesthesia.

German text books began to include accounts of the method. Kronig developed his own technique, and an illustrated description of this appears in the 1912 edition of the operative treatise written by himself and Doderlein. To those interested in the many variations which appeared during the years 1906-20, the monographs of Kustner and Vogt will prove useful. To go into them all here would only render the rest of this work redundant, for now as then, nearly all succeeding modifications have had their roots in three fundamental

procedures—the transperitoneal transverse operation of Kehrer, the peritoneal suture method of Frank, and the simple transperitoneal longitudinal operations evolved by Sellheim, Opitz, Krönig, and their contemporaries.

French-speaking surgeons were early introduced to the operation by such discursive papers as those of Fraipont and Jeannin. It was not until the early twenties, however, that the interest of the Belgians and French took on a lively and intensely practical aspect. Further reference to their work will be found in later chapters. With certain exceptions (Wodon, Jullien, et al.), most operators in these countries practise the vertical incision in the lower segment.

In the four or five years immediately following Frank's publication, papers dealing with the new procedure appeared in Italian periodicals by Resinelli, Acconci, Micheli (1909-11), and others, but their writings were chiefly of a casuistic nature. In 1921, Gaifami, then assistant to Pestalozza in Rome, was the first to publish a considerable series of lower segment Cæsarean sections. Now the operation is the one most commonly performed in the maternity hospitals in Italy to-day. Quite recently, Revoltella, at one time a pupil of Gaifami's and now Director of the Obstetric and Gynæcological Clinic in Catania, has not only contributed valuable additions to our knowledge of the lower segment, but has directed attention to the transverse uterine incision—the one which he now favours and is doing his best to popularize among his countrymen.

The present popularity of the operation in many of the leading clinics of the United States of America is due to the enthusiasm with which it was received and further modified by Beck, Hirst, and DeLee. DeLee has remained faithful to the longitudinal cervical incision. On the other hand, the operation developed along different lines in this country. It is now more than twenty years since Munro Kerr introduced the operation to British obstetricians. After using it on a few occasions he quickly forsook the vertical for the transverse uterine incision as practised by Kehrer and Frank. Yet despite the attention that he and his colleague Hendry continued to direct upon its many advantages, it was actually not until 1931, after the appearance of a paper by J. St. George Wilson (Liverpool), that the lower segment operation began to be at all widely employed in a number of the leading maternity hospitals. Since then several papers have been published giving the results obtained by individual surgeons on patients operated on in this country.

RESULTS IN VARIOUS CLINICAL

REPORTER	NUMBER OF OPERATIONS
St George Wilson (Liverpool)	50
Bailey (Manchester)	119
Fryers (Newcastle on Tyne)	150
*Claye and others (Leeds)	93
Kerr J Munro (Glasgow)	123
*Walsh and others (Liverpool)	352
Gilliat (London)	111
Green Armytage (London)	95
Marshall (Liverpool)	170

Maternal mortality (unreduced) = 1.42 per cent in 1263 operations

* These results were communicated to the North of England Obstetrical and Gynaecological Society during 1936

To these may be appended some figures furnished by DeLee in 1937 —

CHICAGO LYING IN HOSPITAL 1914-36 (all causes)

TYPE OF OPERATION	CASES	DEATHS	PERCENTAGE
Classics	168	11	6
Laparotrachelotomies	1875	18	0.96 (less than 1)

CITY OF CHICAGO 1934 (all causes)

TYPE OF OPERATION	CASES	DEATHS	PERCENTAGE
Classics	490	27	5.5
Laparotrachelotomies	541	11	2

Daily has recently offered an analysis of the 500 cervical sections performed in the Chicago Lying-in Hospital between 1931 and 1934. The maternal mortality was exactly 1 per cent. Such a figure is even more arresting when we consider that only one death can truly be attributed to the operation, this was the result of intraperitoneal hæmorrhage probably resulting from the division of an omental adhesion. Two mothers died from tuberculous meningitis, and one from a decompensated cardiac lesion—the indications for the Cæsarean sections. The fifth was the result of general infection and endocarditis—also in a patient with old-standing heart disease. The great majority of these patients were delivered under local anaesthesia.

Intraperitoneal cervical, or lower segment, Cæsarean section is now a firmly established procedure. Conceived by Oslander and

Jörg, it became one hundred years later, in the hands of Frank, a proved reality. Thirty years have elapsed since then, and it has well stood the test. Writing in the first flush of his thirteenth success Frank closed one of his memorable papers with these words :—

“ Wir opfern nicht, sondern wir retten sie beide.”

If we have not yet proceeded the whole way, the operation has led us within measurable distance of such an ideal.

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CHAPTER II

ANATOMY, INCISIONS, AND NOMENCLATURE

THE ISTHMUS UTERI

General Features.—This is now well recognized as a separate division of the uterus. Its canal varies in length between 5 and 10 mm. and its upper limit can be fixed with the naked eye, especially when for any reason the endometrium of the body is thickened (pre-

menstrual phase, ectopic gestation, decidua of early pregnancy). The caudal end is not so readily apparent, but can always be defined from the characteristic mucosa of the slightly fusiform cervical cavity with the aid of the microscope. The upper and lower limits are respectively the orificium isthmi internum (anatomical internal os—Aschoff) and the orificium isthmi externum (histological internal os—Aschoff). (*Fig. 12.*)

While the mucous membrane of the isthmus bears an essential resemblance to that of the corpus, it is relatively thin, poor in glands which have a tendency to cystic formation, and plays little or no part in the menstrual cycle. This lack of reaction to hormonal excita-

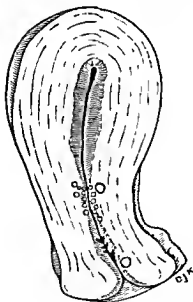


Fig. 12.—Sagittal section of uterus.
A, B, isthmus.

tion probably explains the rarity with which adenomyosis occurs in this segment of the uterus (Frankl). It is also of interest to note here that when Cesarean section is terminated by supravaginal hysterectomy, and as much as 4 or 5 cm. of lower segment is left attached to the cervix, there is no reappearance of menstruation.

Some attribute to the isthmus a special pathology of its own. Malignant neoplasms may be found to arise in and even be entirely

restricted to this region. It would appear to be much more common, however, for the mucous membrane of the isthmus to play the part of a barrier and to limit the spread of growths (or even infections) which arise either above or below it (Bernabei)

Topography.—

In front, the covering peritoneum is mobile, being attached to the isthmus only by loose connective tissue. The level at which the peritoneum becomes firmly united to the uterine wall is an *approximate* indication of the upper limit of this segment. In the majority of subjects the supratrigonal region of the bladder has little direct relation to the isthmal portion, being separated from it by the uterovesical pouch of peritoneum. There are, however, some exceptions (*see Fig 28, p 44*)

Behind, the peritoneum is continuous with that covering the supravaginal cervix and the upper part of the posterior vaginal wall. While it is not so densely adherent as that clothing the corpus, its union to the posterior wall of the isthmus is much more intimate than that existing in front.

Laterally, there is the uterine artery with its accompanying veins. My own observations lead me to believe that the point at which the former first touches the uterus lies nearer to the lower than the upper limit of the isthmus.

Blood-supply.—Radiological examination of injected uteri has shown, according to Frankl, that the vascularization of the isthmus "is a distinct and individual one." But such peculiarities as this worker has detected are not momentous, and, like its lymphatic drainage and nerve supply, which have been the subject of numerous inquiries, have no special significance in the lower segment operation.

Naturally it is of some importance to remember that, as in the rest of the uterus, the calibre of the vessels is greater as the lateral margins of the organ are approached, and that the arterial anastomosis between the left and right systems across the midline of the uterus is not a very rich one. It is on the latter fact that some surgeons seek to justify their choice of the median vertical incision.

Changes during Pregnancy.—The mucous membrane undergoes decidual changes, but these are but a poor reflection of those occurring in the corpus. The compact layer is almost entirely absent, while the spongy layer is thin and may still show a few elongated glands. From our point of view the most important event

is the absorption of the canal of the isthmus into the general uterine cavity (*Fig. 13*). The orificium isthmi internum begins to disappear in the third month of pregnancy, and the whole canal is gradually spread by the growing ovum until its lower pole descends to the level of the true internal os. The isthmus uteri has now become the lower segment.

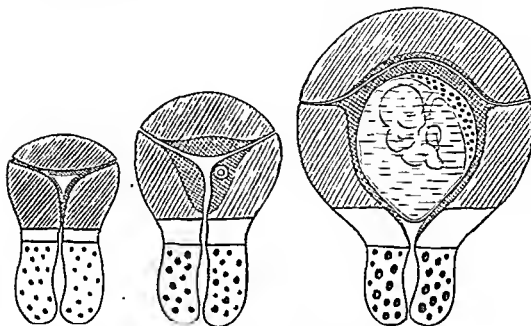


Fig. 13—Showing the absorption of the isthmal canal into the general uterine cavity in the third and fourth months. (*After Revoltella.*)

Firm union between the decidua capsularis and the decidua vera is said to be lacking in the lower segment, with the result that the membranes at term are found only lightly attached to the uterus in this region. This loose union, as Frankl and others have suggested, is probably an important factor in permitting further elongation and expansion of the lower segment during pregnancy and, later, its complete development in labour. When, however, a placenta prævia occurs, it is not unnatural to expect that these alterations will be impeded or delayed, and there is some evidence, indeed, that this does occur.

THE LOWER SEGMENT

Only the recording power of the cinematograph could do full justice to the swiftly changing features of the lower segment which

can be followed during a single operation from the moment the uterine incision is begun until the time has arrived for closing the abdominal wound. There is, however, one period during which this part of the uterus is in a state of relative stability. The particular characteristics of the lower segment, its length, its thickness, and its relative dependence on the state of the corpus, are all best displayed

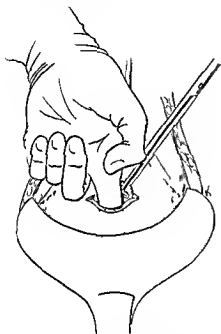


Fig 14—The scalp forceps have been attached. The index finger is inserted between the head and the anterior wall of the lower segment. The distance of the incision from the internal os can thus be measured before the uterus has been evacuated.

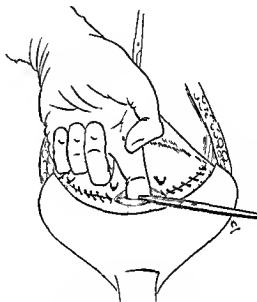


Fig 15—Method of measuring height of incision above the internal os after delivery of infant and placenta.

immediately after the completion of the third stage of labour when the uterus is in a state of maximal retraction. From observations made at this moment certain deductions are permissible, and we are thus enabled to 'reconstruct' the lower segment during those phases when its peculiar individuality is not quite so easily discernible.

The impressions of the anatomy and physiology of this part of the uterus, in so far as they directly bear upon the operation, have been arrived at by the author in various ways. As the methods employed can be repeated by any other operator they are set out briefly below —

I. LIVING ANATOMY.—

a. The Length of the Lower Segment.—This can be determined both before and after delivery by measuring the distance from the internal os to the line of firm attachment of the uterine flap of peritoneum. In cases where this latter level is not found to correspond at the end of the operation with the lower border of the thickened corpus, the measurement is of course discarded. (Figs. 14, 15.)

b. The Relative Thickness of the Lower Segment and Corpus.—Before delivery this can be studied by using a vertical segmento-corporeal incision, care

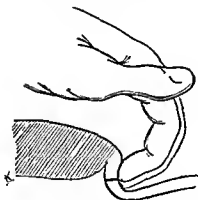


Fig. 16.—Palpation of lower border of thickened corpus through the lower segment after closure of the uterine incision (Lower segment, green)

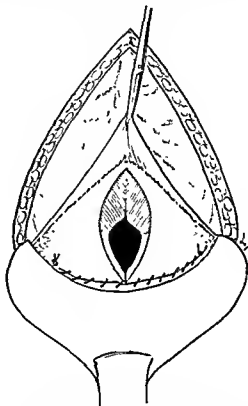


Fig. 17.—Segmento-corporeal incision placed above the transverse uterine incision. In this patient labour was advanced. The difference in thickness between the firmly contracted corpus and the thinner lower segment is thus demonstrated diagrammatically. (Lower segment, green.)

being taken to maintain the membranes intact. After delivery of the infant and placenta the difference is obvious and much increased.

c. The Site of the Incision in Relation to the Body of the Uterus.—This is studied after delivery. The lower edge of the thickened corpus can be easily palpated and its height above the incision measured (Fig. 16). Another way to appreciate fully that the incision falls on the lower segment is to practise a reversal of Hegar's sign. One hand is passed down behind the corpus and the other applied to the front of the organ. When the uterus is in a firm state

of contraction the lower edge of the body is easily identified with the tips of the fingers and its relation to the transverse incision noted. In one instance I have, after closing the transverse wound, placed a



Fig. 18—Sagittal section of uterus illustrated in *Plate I*. The arrow marks the uterine incision. The presegmental peritoneum has been raised to the level at which it becomes firmly attached to the corpus uteri. The comparative thicknesses of the body and the lower segment immediately after delivery of infant and placenta are particularly well demonstrated.



Fig. 19—Sagittal section of uterus removed after careful two layer closure of the uterine incision (marked by arrow). The patient (*Case 235*) was not in labour. Despite the disparity of thickness between the upper and lower edges of the uterine wound accurate union has been secured. The presegmental peritoneum is also shown. The specimen should be compared with that in *Fig. 18*.

vertical incision in such a way as to demonstrate the segmento-corporeal junction (*Fig. 17*). Unless these studies are made only after the empty corpus has retracted to its maximal extent, the resulting deductions are apt to be erroneous (*Fig. 36, c*). The use of general anaesthesia can also mislead the observer. Generally speaking, the

conclusion is then drawn that there is a much greater extent of lower segment above the uterine incision than, in fact, actually exists.

d. Distension and Elongation of the Lower Segment.—Many opportunities have arisen for a study of this region in patients in whom labour has been obstructed and the retraction ring has risen to pathological heights (*see* Chapter IX).

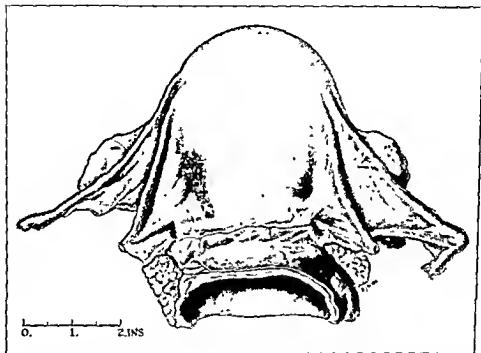


Fig. 20.—Uterus and portion of bladder removed from a woman who died fourteen days after transverse lower segment Caesarean section. The line of union in the presegmental peritoneum is clearly seen. The patient was admitted to the Liverpool Maternity Hospital with contracted pelvis and obstructed labour. There was a large hematoma visible at the vulva and occupying the rectovaginal septum—the result of perforating the rectum with an enema nozzle. Death was due to extensive perirectal suppuration. At post-mortem the peritoneal and uterine cavities were perfectly normal and free from all infection. For this specimen I am greatly indebted to Percy Malpas, Esq., F.R.C.S.

e. The Peritoneum and Bladder.—After division of the peritoneum immediately above its reflection on to the bladder, the uterine flap has been dissected and raised to various levels. At the end of the operation it has thus been possible to test the truth of the statement, so generally accepted, that the level of its firm adhesion to the uterus marks the upper limit of the lower segment.

Varying degrees of fascial union between the supratrigonal region of the bladder and the front of the lower segment have also been observed (*see* p. 44).

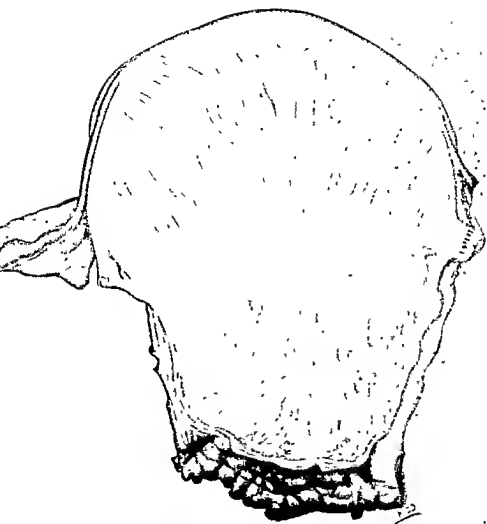


PLATE I.—Uterus removed immediately after closing the transverse incision with one continuous suture (Case 233, p. 204). *b*, Level to which peritoneum was raised during operation. *a*, Level to which peritoneum was actually mobile on the underlying lower segment and corpus uteri (see Fig 18). The height over which the peritoneum can be mobilized increases as the lateral borders of the organ are approached. ($\times \frac{1}{2}$.)

2 EXAMINATION OF SPECIMENS OBTAINED AT OPERATION—In a few cases the operation has been completed by removal of the uterus. In two of these (the operation in one being performed before the onset of labour, in the other very late in labour) the incision was closed and the uterus then amputated below it (*Plate I* and *Figs 18, 19*)

3 CÆSAREAN SECTION IN THE POST-MORTEM ROOM—This has been done on one occasion in a woman dying at the end of the first stage of labour. The head was in the pelvic brim. The middle of

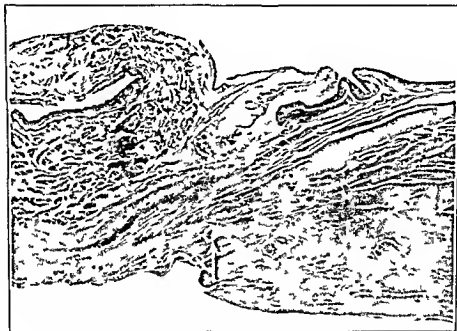


Fig 21—Sagittal section of lower part of corpus, lower segment and bladder of specimen illustrated in *Fig 20*. The uterine incision is healed. The arrow points to a piece of unabsorbed catgut.

the transverse incision was found to fall within an inch of the external os.

4 STUDY OF UTERI IN PATIENTS WHO HAVE DIED IN THE PUERPERIUM FOLLOWING CÆSAREAN SECTION—Three are pictured in this book (*Figs 20, 21, 75, 85*). Among others not shown was that from the patient whose history is given on p. 121.

5 A STUDY OF OTHER POST-MORTEM MATERIAL IN WOMEN DYING IN THE PUERPERIUM AFTER VAGINAL DELIVERY (*Figs 22, 23*).

6 BIMANUAL EXAMINATION SOME MONTHS AFTER DELIVERY—This has been done in those few patients subjected to hysterectomy. The length of the remaining cervical stump was estimated and the length of the cervical canal (and ? isthmus) measured. The patient

from whom the uterus illustrated in *Fig. 18* was taken, was examined eight weeks later. Bimanually the cervix was found reduced to a small stump and its canal measured 16 mm.

The Lower Segment at the End of Pregnancy.—The lower



Fig. 22—Sagittal section of uterus, bladder, vagina and rectum from a patient dying twenty-four hours after vaginal delivery. The cervix is clearly seen and the lower segment is already greatly reduced in length. The bladder has been partly detached from the cervix and the peritoneum has been raised from both the bladder and the lower segment. The region of the uterine incision is well demonstrated.

segment is between one-fourth and one-fifth of the total length of the uterus. Its junction with the supravaginal cervix is at the level of the internal os and, when this is closed, is quite abrupt. The upper boundary is not so easily defined. The transition from the thinner lower segment to the thicker corpus is a gradual one, and this zone may be 4 to 5 cm. in length. The anterior wall, which is concave within and lies almost horizontally with the patient in the erect position, is longer and thinner than the posterior wall, which is almost straight and nearly vertical in direction. The differences in length and thickness between the two walls are best appreciated after the uterus has been emptied, and especially when the operation is followed by hysterectomy.

LENGTH.—The length of the lower segment according to my own estimations varies widely, but is usually between 7 and 10 cm. The thickness of the anterior wall is also variable,

but rarely exceeds 6 mm.; in a large number of cases it is not more than half this.

TOPOGRAPHY.—

Anteriorly, and from below upwards, the lower segment may be related to: (1) A small area of the supratrigonal region of the bladder; (2) The bladder with the uterovesical pouch of peritoneum intervening; (3) The upper border of the symphysis pubis; and (4) The lowermost portion of the anterior abdominal wall. With the exception of the small vesical area it is covered in its whole extent

by peritoneum to which it is attached only by loose connective tissue. Apart from the latter the lower segment possesses a very distinct layer of fascia which accounts for the greyer and paler colour of its surface in comparison with that of the rest of the uterine wall. This sheath is most clearly seen over the lower uterine flap when about to suture the wound. It can then be picked up as a separate layer and may even be momentarily mistaken for the vesical flap of peritoneum. While a few surgeons unite this fascia with a third row of sutures, most are content to include it in the second uterine suture.

Laterally lies the voluminous uterine artery, masked by the enormous veins in the lower parts of the broad ligament. The ureter, as a structure closely related to the lateral pelvic wall, is quite remote and is never in any danger.

When the presenting part is deeply engaged the anterior wall of the lower segment is almost wholly within the pelvis. It is partly abdominal and partly pelvic when the head is high or overriding the brim. Late in labour on the other hand it may be raised entirely into the abdomen.

Owing to the inclination of the pelvic brim and the greater length of the posterior pelvic wall, the *posterior wall* of the lower segment is in almost all circumstances confined to the true pelvis.

The Lower Segment late in Labour—Reference is made particularly to those cases in which the cervix is taken up and dilatation of the os advanced or even complete.

Certain features of the lower segment are now more clearly distinguishable. Its upper limit is raised and its junction with the active corpus often marked by a *groove*. The appearance of the

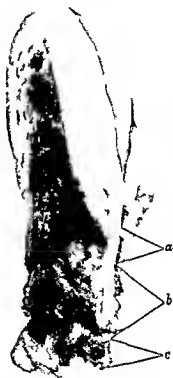


Fig. 3.—Another specimen from a patient dying in the early puerperium.
a Lower segment b Cervix
c Vagina

presegmental peritoneum is also changed. It is now thinned and tautly stretched over the distended and even ballooned lower segment, and a sparkling translucency has replaced its usual dullness. Fine spidery vessels can be seen running in its substance. Beneath its lower part, in the neighbourhood of the uterovesical reflection, the subperitoneal tissue may be quite œdematous, and blebs even become apparent in the peritoneum itself. Further, the connective tissue between bladder and cervix has undergone softening and loosening, a factor which permits the latter to be drawn upwards and away from the former organ. In the above circumstances the peritoneum can no longer be plucked up from the underlying muscle with the same freedom. Once it is incised, however, a flap can be raised as high as the level of the constricting ring with the greatest ease.

On the other hand, the inferior limit of the lower segment can no longer be defined, by sight or touch, with absolute precision. Its lower border passes imperceptibly into the stretched and greatly thinned supravaginal cervix, and, if dilatation is complete, lower segment, supravaginal and vaginal cervix now form one unbroken wall—the uterine part of the parturient canal.

The 'lower segment' in these cases is rarely more than 2 or 3 mm. in thickness, and its length, measured from the cervicovaginal junction to the level of the adherent peritoneum or constricting ring, may be anything from 10 to 15 cm., or even more in exceptional cases (*see* "Constriction Ring," Chapter IX).

The exact proportion which the cervix contributes to the formation of the 'lower segment' of advanced labour is difficult to determine at operation. Acosta-Sison, who has made this point the subject of deliberate *anatomical* investigations, comes to the following conclusion: "The isthmus uteri and the cervix enter into the formation of the lower passive segment during the first and second stages of labour, and, contrary to the prevailing view, the cervix forms a far greater proportion than the isthmus of the structure of the lower passive segment. In none of the specimens did the cervix measure less than or even equal the length of the lower uterine segment proper. The latter is relatively long before the cervix dilates. But as the dilatation and consequent elongation of the cervix progresses, the lower uterine segment becomes correspondingly shorter."

There is no reason why this problem should not be accurately solved. If the longitudinal incision is practised when the cervix is fully or nearly fully dilated it is possible to remove for microscopical

study a strip of tissue from the level of the upper limit of the incision to the external os. If suitable material is offering the author hopes shortly to be in possession of definite data on this question.

The Bladder—The positions which the empty organ may occupy before and during labour are illustrated in the accompanying diagrams (Figs 24–28). In advanced labour the floor of the uterovesical space is always elevated, and the height to which it is raised is some indication of the degree to which the cervix contributes to the formation of the lower segment.

The Uterine Artery—After the uterovesical peritoneum has been opened up, this artery can be palpated on a level with the ends of the proposed incision. But if after beginning the uterine stitch the suture is drawn upon and the left border of the uterus turned to the front, the artery can then be seen quite clearly lying bound to the uterine muscle by a definite sheath of fascia. The extremities of the incision rarely approach within an inch of these vessels.

At this moment, too, a striking change in the calibre of the veins in the broad ligament will be noticed. With retraction of the uterus they have completely collapsed and, excepting a few in the upper part of the broad ligament, can no longer be clearly identified in the loose connective tissue of the parametrium.

Changes in the Lower Segment during the Incision, Extraction of the Infant, and Third Stage of Labour.—

1. AT TERM OR IN EARLY LABOUR.—

Incision—If the transverse incision is made with the knife, retraction of the muscle is seen to occur in successive layers. As it is easy to miss the more superficial of these in the final suture, the incision is best enlarged with the scissors or the fingers, when the above lamellation does not occur to the same extent.

Delivery—The elasticity of this region is considerable and is particularly well demonstrated during extraction of the aftercoming head. The lower edge of the wound becomes tightly stretched across the forehead and almost as thin as paper, yet remains intact.

Third Stage—The lower uterine flap remains quite toneless and drops loosely into the depths of the pelvis, where it is usually hidden beneath a small collection of blood and clot. The posterior wall of the lower segment bulges into the wound. The upper uterine flap undergoes some shortening and its edge visibly thickens. But it is still some 4 to 5 cm. in length and can be moved backwards and forwards on the moderately contracted corpus. The transition from



Fig. 24.—Common arrangement of bladder and peritoneum before onset of labour.

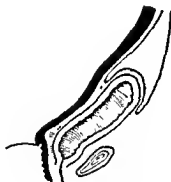


Fig. 25.

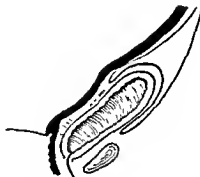


Fig. 26.

Arrangements commonly met late in labour.



Fig. 27.



Fig. 28.

Arrangements which are only rarely seen. That in *Fig. 28* was present in the case from which the illustrations for the longitudinal operation were drawn.

the thinner lower segment to the thicker corpus, while now more obvious, is still a relatively gradual one. After the birth of the placenta, however, and when *firm* retraction has been aroused in the corpus, the attached lower segment undergoes a further shortening and increase in thickness (Fuchs, Mikulicz-Radecki, Caffier). The length of this upper flap now rarely exceeds 2.5 cm. We have therefore to close a wound the upper edge of which is often twice as thick as the lower. This is really no disadvantage, nor does it endanger the union if the first stitch unites the deeper, and the second the superficial, half of these edges (*see Fig. 19*). Once this is complete and the lower flap has secured an anchorage to the active portion of the uterus, it too is seen to thicken progressively. As the uterovesical peritoneum is being restored the whole lower segment is still undergoing a decrease in its length and breadth and the uterine wound is sinking more deeply into the pelvis.

The firmer the state of retraction in the corpus, the greater the shortening and thickening of the lower segment. Retraction in the lower segment *does* occur but it is mainly a function of the corpus. This is beautifully shown in cases where a placenta prævia has been removed from the posterior wall of the lower segment. I have often watched oozing from the placental bed cease immediately when firm retraction was aroused in the corpus, only to recur again as soon as the latter relaxed.

Before closing the uterovesical peritoneum I have frequently dissected the uterine flap of peritoneum as high as the level of its firm attachment to the uterine muscle. This point is always on the corpus and may be as much as 2 to 3 cm. above its lower border.

2. LATE IN LABOUR —

There is now ample 'lower segment'. The conditions observed will vary with the level at which the incision is placed. If this falls a few centimetres above the upper limit of the bladder and the latter is left undisturbed, definite muscular tissue is incised and is easily recognizable no matter how thin the uterine wall. *True lower segment has been entered*. The changes during the third stage are in general similar to those which occur in the cases operated on at term or in early labour, and there is likewise a noticeable degree of thickening and retraction in the upper edge of the wound. But the final level of the incision after suture will, in most instances, be found to lie at a greater distance from the lower edge of the corpus. The whole lower segment, too, remains more loose and supple, and if the

fundus is depressed its anterior wall bulges forwards and its lateral walls outwards, as the lower edges of the corpus become invaginated into its cavity.

When, however, the elevated bladder is wiped completely down and the incision placed low on a truly retrovesical portion of the uterus, the character of the uterine wall is markedly different. Muscle is barely in evidence. The tissue is sodden and suffused with blood. It can be likened to blotting-paper soaked in purple ink, and it tears just as readily. A flick of the finger is sufficient to *enlarge the initial incision as far as the lateral borders of the organ. The incision has fallen in the thin and elongated cervix.* This must be the case, as the external os, when a lip of cervix has persisted, will on many occasions be found to lie within an inch and a half of the lower edge of the wound. (Indeed it is not difficult in some of these cases to incise the vaginal wall—an accident which has happened to one of my colleagues (C. J. K. Hamilton) and myself without doubt on at least one occasion, and very likely on several others.)

When the cervix is incised there is little or no disproportionate thickening of the edges of the incision. The wound should be sutured with a round-bodied needle taking in its course the whole thickness of the tissue. This is then inverted by a second suture which picks up the superficial muscle and the cervicovaginal fascia. The wound finally lies very deeply behind the bladder with a very considerable length of lower segment above it. I defy such an incision ever to act as the path for the spread of infection from the uterine cavity to the peritoneum.

Defective Development of the Lower Segment.—There is another type of lower segment which will occasionally be met: even after many hours of labour it is found that its wall is unusually thick and short. In these cases dilatation has usually been sluggish and the thick lips of the cervix will rarely admit more than the tips of two or three fingers. One is left with the definite impression that defective development or a failure of 'diastole' of the lower segment may be an exceptional cause of difficult labour.

There are three other conditions in which the length of the lower segment appears to be diminished. These are: (1) Prematurity; (2) Placenta prævia; (3) Premature rupture of the membranes with absence of labour pains. Unless particular care is taken in such cases to place the initial incision really low, it will finally be found

to be either in the corporeo-segmental junction or actually in the corpus uteri

INCISIONS AND NOMENCLATURE

The Incision in Relation to the Architecture of the Uterine Wall.—

"The selection of the most suitable direction of the incision will be decided when we know how the muscular fibres of the lower uterine segment are distributed" (MUNRO KERR, 1921)

Until recently the direction of the uterine incision had been chosen more with regard to the neighbouring anatomy than to the actual architecture of the uterine wall. Since the publication of Goerttler's work in 1930 such an approach has become less reasonable.

Goerttler* (Kiel) studied sections (50 to 100 μ) cut by hand or the freezing microtome from fetal, nulliparous, gravid, and puerperal uteri. These, prepared from the fresh and unfixed organs, dehydrated by a special process, and powdered with fine gold-bronze dust, were examined microscopically with the aid of intense oblique illumination. After blowing away the excess of gold dust, sufficient was found to remain to reflect a true negative of the surface relief. The sections were studied under low magnifications and photographed.

Goerttler was able to establish that the essential structure of the uterine wall lay in two intersecting systems of muscle-fibres each the mirror image of the other, and that everywhere in the uterine wall the muscular arrangement exactly resembled that of a lattice or trellis ("*Gitterwerk*") The fasciculi of one side, arising beneath the peritoneal coat, proceed from without and above, downwards and inwards, and, after intersecting with their fellows of the opposite side, end beneath the endometrium (*Figs 29, 30*). In the corpus intersection of the opposing systems occurs at right angles, in the isthmo-cervical segment the angle is obtuse, while in the actual cervix it practically ceases to exist—the arrangement is almost circular.

With the unfolding of the isthmal canal and the absorption of the isthmus into the general uterine cavity during pregnancy, the fibres above the level of the insertion of the uterosacral ligaments assume a steeper course, and intersection with the opposing system occurs at a slightly sharper angle. In the cervix alone is there little alteration, the circular or transverse arrangement being maintained. A further feature which is peculiar to the lower segment in late

* Now Professor of Anatomy in the University of Heidelberg

pregnancy is the fact that in this region the inner ends of all fibres terminate at a lower level than their outer extremities. In this way they differ from those in the corpus, which have their internal endings

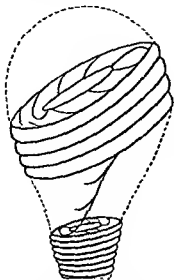


Fig. 29—Showing diagrammatically the disposition of one of the two muscular systems in the uterine wall.

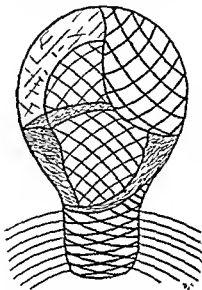


Fig. 30—A composite diagram of the architecture of the uterine wall.

(Figs. 29 and 30 redrawn from Goertler.)

some above and others below the level of their subperitoneal origins. The retraction ring would appear to arise at the junction of these separate and distinct arrangements.

Goertler's original paper was of monographic dimensions. In it are also set out his own brilliant conceptions of the functions of the uterine muscle in the light of its newly discovered structure. During 1937 I was very kindly offered an opportunity of examining several of Goertler's preparations. It was impossible to doubt the validity of his anatomical findings.

Goertler's discoveries have naturally exerted their greatest influence in Germany. The result has been to swing the pendulum again, and the transverse and slightly curved incisions, so long neglected, are now becoming popular in many of the clinics of that country.

The accompanying diagram (Fig. 31) shows some of the uterine incisions which have been advocated. It would seem that less

damage to the muscular arrangement will result from the use of the moderately curved transverse incision than from any other

Nomenclature—Here we may conveniently summarize the chief possibilities of the two incisions most commonly employed

THE TRANSVERSE INCISION—It is presumed that in all cases the bladder is pushed down and the incision placed as nearly retrovesical as conditions will permit

1 *In those patients in whom there is defective development of the lower segment* The incision will finally lie very close to the segmento-corporeal junction despite every effort to keep it low. In one specimen (see p 120) it is actually seen to be in the corpus uteri

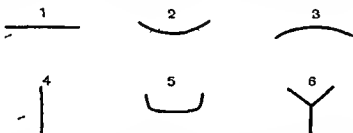


Fig 31. Some incisions shown in relation to the retrovesical reflection of peritoneum. 1 Doerfler. 2. Type used by many including the author. 3 Munro Kerr's incision. 4 Vertical incision. 5 Bailey's trapezoid incision. 6 Dr. Kerr's incision.

2 *When the uterus is not in labour, or, if in labour the cervix is not more than half dilated* The incision will be in the true lower segment

3 *If complete or almost complete dilatation of the cervix is present* The incision here will usually fall in the boundary zone between the lower segment and cervix or actually in the latter

4 *If the operation is performed late for the relief of obstructed labour with distension of the lower segment and in the presence of a high retraction ring* Full advantage can be taken of the retrovesical space and the incision placed in true cervical tissue (Fig 32). Whether a cervical scar would be more resistant in a subsequent labour I do not know. There would certainly be no question of its rupturing during pregnancy

THE VERTICAL INCISION—

1 *In the patient in labour and in whom the cervix is not less than half dilated* It should be possible to confine the incision to the lower segment and cervix

2. *In cases of obstructed labour:* It will always be possible to place the incision wholly in the lower segment and cervix.

3. *In all other cases:* A considerable proportion of the so-called lower-segment operations would actually be more truly described as segmento-corporeal. Even if the original incision has been limited to the lower segment, it has either spread or has had to be prolonged into the corpus during the extraction of the infant. A few obstetricians, in publishing their statistics, state the proportion of segmento-corporeal sections. Buë, for instance, gives 15 per cent.



Fig. 32.—Microphotograph from line of uterine incision marked by arrow in Fig. 18. Portions of cervical glands are seen.

To those whose experience will allow them to agree with the above conclusions, it will be obvious that the question of accurate nomenclature will be a difficult one if strict regard is to be paid to the various surgical and anatomical possibilities. The confusion which exists is illustrated by the numerous names under which the operation still passes—cervical Cæsarean section, the lower (uterine) segment operation, cælio-isthmotomy, laparotrachelotomy (DeLee), the low or deep Cæsarean, and suprasymphysial section.

Of them all Martius considers "cervical Cæsarean section" to be the least justified. Certainly this is true, for it can be applied with accuracy only to the exceptional case. It is a survival of the

days when the lower segment was believed to arise from the upper third of the cervix (*Fig 33*) The "lower-segment operation" has perhaps the most justification, for it is truly descriptive in the majority of cases

Transverse v Longitudinal Uterine Incision.—In 1927 DeLee enumerated the seven disadvantages of the transverse operation —

1 *The danger of hæmorrhage from the large vessels at the side of the uterus* Tellheim's anatomical studies proved that the blood-vessel supply is least in the midline

In actual practice this danger is rarely in evidence, and only a few instances are on record in which injury to the lateral vessels has proved a serious complication As regards the amount of bleeding during the actual incision, extravagant claims have been made for each method More disinterested writers, like those German surgeons who are fast obtaining an experience of both incisions, have little to say on this point

2 *The incision and its sutures extend into the vascular venous field, and if, as not seldom happens, there is a slight wound infection, thrombosis and embolism are invited*

The occurrence of thrombosis and embolism depends on many factors other than the above, and personally I am not aware of comparable statistics which either prove or disprove the point raised by DeLee Philipp, however, has reported an isolated instance where white leg resulted from extensive tearing of the parametrium during extraction of a large infant

3 *If the wound suppurates, the pus is higher in the abdomen* With the median incision, which extends almost to the external os, the pus finds readier exit

This is considered under No 6

4 *In suturing the wound the upper half retracts into the body and one has a thick half to sew to a thin half*

Admitted, but without any significance In the specimen shown in *Fig 19* the lower edge of the uterine incision was only half the thickness of the upper retracted edge Yet absolutely accurate apposition was obtained

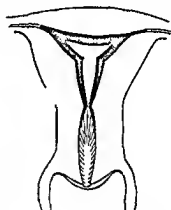


Fig 33 — Cervical origin of lower segment (Hustner 1982)

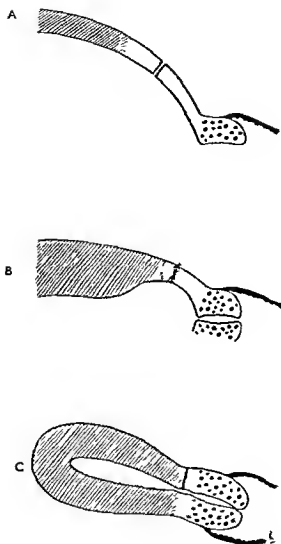


Fig. 34.—The relative levels of the transverse uterine incision in the patient operated on before the onset of labour. *A*, Before delivery of the infant; *B*, After delivery of infant and placenta. *C*, When involution of the uterus is complete. The scar is now in the isthmus uteri. (*Corpus*, shaded; *Lower segment*, green; *Cervix*, red.)

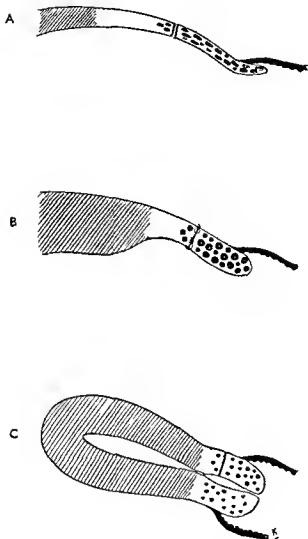


Fig. 35.—The relative levels of the transverse uterine incision when a really low retrovesical operation is performed late in obstructed labour. A Before delivery of the infant. B After delivery of infant and placenta. C When involution is complete. The scar is in the true cervix. (Corpus shaded, Lower segment green. Cervix red.)

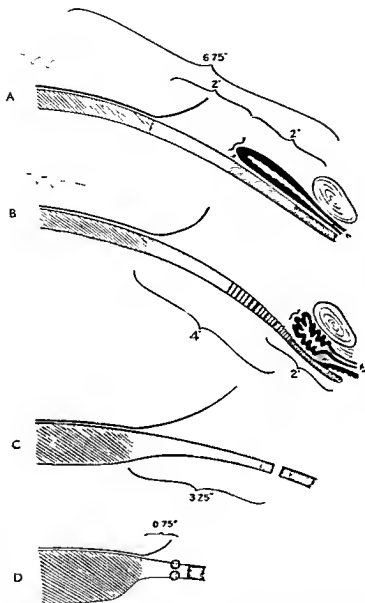


FIG. 36.—Measurements from an actual patient operated on in labour, with the cervix about three-quarters dilated. The uterus was intentionally incised higher than was necessary. A. The abdomen opened and the presegmental peritoneum incised and raised. The junction of corpus and lower segment was accepted as occurring at the level where the peritoneum obtained firm union with the uterus. B. Bladder wiped down and uterus incised. C. After delivery of child but before delivery of placenta. Upper flap of lower segment apparently of considerable length. D. After birth of placenta and corpus strongly contracted. Incision only 0.75 in. below lower border of corpus, therefore in this case the incision fell in lower segment and not in cervix. (Corpus, shaded. Lower segment, green; Transition zone, red and green; Cervix, red.)

5 *A weak scar which is more likely to give way in subsequent labour. This follows directly on No 4*

It is strange DeLee should have raised such an objection, for when this was written there were 12 known cases of rupture of the vertical and none of the transverse scar. Now the corresponding figures are 45 and 5. Even if we have to grant that the total number of transverse operations is still smaller than the vertical, the evidence is, *prima facie*, against DeLee's claim.

6 *A median scar is stronger than a transverse one, because it is quieter during healing and the line of distraction of the uterus in pregnancy and labour puts the cross line on a greater strain*

In the light of present knowledge the main statement appears to have been simply presumption. Likewise the explanatory clause is now untenable if Goerttler's discoveries (1930) are correct.

7 *The opening in the uterus in the transverse operation is nearer the peritoneum, and lacks all or has less protection by the superimposed bladder*

There is some, but very little, justification for this statement. It is true that when it was written the transverse incision was frequently pictured as falling "somewhere" in the lower part of the uterus, and its leading protagonists did not emphasize the necessity of mobilizing the bladder, incising the uterus as low as possible, and finally bringing the wound to be in a truly retrovesical position. For laying emphasis on these latter features we are chiefly indebted to Phaneuf, whose method of operating I have taken as a pattern for my own.

The whole question would appear to be reduced to this. The long-drawn-out argument on the relative merits of classical and segmental Cæsarean section is finally closed. The superiority of the latter is no longer seriously challenged. But around the comparative values of the segmental incisions a fresh storm of dissension is raging. This too will be stilled and an answer to the problem found, but not for another decade or more.

In the meantime, DeLee, myself, and hundreds of others will act on prejudice and impressions, theories and experience. For instance, I am alarmed when I read that Merikallio lost two patients from peritonitis, the infection reaching the peritoneum in each case only through the corporeal part of his vertical incision, unavoidable extension of the wound having occurred during the operation. I regard almost with satisfaction the fact that in the 45 reported cases

of subsequent rupture of the vertical scar the corpus was involved in several, and in at least five of those in which the previous operation was admittedly segmento-corporeal the rupture was largely confined to this part of the incision. I am impressed with the fact that the *whole* of the transverse incision can be placed at a level which is always considerably lower than the *highest point* of the vertical incision, and consequently the risk of peritoneal infection must be reduced. I am deeply influenced by the fact that Phaneuf has employed each incision in more than 200 operations and has eventually concluded that the transverse is superior to the vertical. Lastly, I believe that in coming to a final decision on the problem, Goertler's discoveries cannot be entirely overlooked.

At the same time I can record with pleasure that no rupture of the scar has been known to occur in more than 1800 laparotrachelotomies (*vertical incision*) performed in DeLee's clinic. In Liverpool the *transverse* incision has been used in a little over half this number of patients, and so far, too, no instance of rupture has come to light. Nevertheless I would suggest in conclusion that the amount of interest displayed in the future of the scar is out of all proportion to its practical importance. The number of reported ruptures (50) is extremely small, and when it is known that not more than 10 per cent of these end fatally, we can at once realize what an insignificant effect the occurrence has on the total mortality of the operation. For myself I shall finally adopt that incision which is shown to offer the surest safeguard against infection of the peritoneal cavity during the puerperium.

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CHAPTER III

ANÆSTHESIA

"At the moment I can see little possibility of still further reducing the risks of Cæsarean section by alterations in the technique of the operation, unless it be that some new way will be discovered or some fresh means found whereby the dangers of anæsthesia can be diminished" (H. MARTIUS)

ANÆSTHESIA EMPLOYED BY THE AUTHOR
IN 246 OPERATIONS

Ether	60
Spinal (reinforced by local 1 and ether, 7)	112
Local (reinforced by ether ethyl chloride or gas and oxygen 15)	74
Total	<u>246</u>

CHLOROFORM

THIS is dismissed briefly. Dmitriev and Bompiani (1931) have each reported a death from its use in Cæsarean section. Katz, with unequalled opportunities for studying the effects of chloroform and other anæsthetics in the post-mortem room, has urged against its employment in obstetrics. According to Klein, G. A. Wagner (Berlin) has banished it from the theatre. There are two broad principles on which it can be justly condemned —

1 It is impossible to reconcile the physiology of the pregnant or parturient woman with the well-known possibilities of chloroform when this is given in quantities sufficient to produce *surgical* anæsthesia.

2 It may seriously interfere with uterine activity, give rise to atony, and produce severe hæmorrhage. "Until 1926 all our sections were performed under ether or chloroform, but these methods were not without their drawbacks on account of the uterine inertia which they are capable of creating" (Percy).

Its very power to relax a uterus should be the sole justification for its use in *operative* obstetrics. As a temporary and emergency measure small amounts of chloroform may be given with great advantage. (1) for the relief of fœtal asphyxia, (2) in threatening rupture of the uterus, and (3) to relax the uterus during the performance of a difficult version.

ETHER

(Including Chloroform-Ether, Ethyl-Chloride-Ether, Nitrous-Oxide-Ether, Etc.)

DISADVANTAGES

Ether is still more widely used in this operation than any other anæsthetic. Its defects set forth below outweigh its other qualities.

1. Uterine Atony and Hæmorrhage.—Grosse states that this has always to be feared when Cæsaean section is performed under general anæsthesia. Lévy-Solal andureau have shown conclusively from their *hystero-graphic* records that anæsthesia delays the onset of contractions in the third-stage uterus, increases the intervals between their appearance, and diminishes their intensity. Such experimental evidence is hardly necessary. Péry, Grosse and Lérout, Garipuy, Laffont, Cambon, Casalta, Phaneuf, and many more have reported troublesome hæmorrhage when operating under general anæsthesia. Apart from what has appeared in these and similar publications this risk of uterine atony and bleeding is admitted in a number of ways:—

a. Indirectly.—Many surgeons circumvent this complication by routine packing of the uterus; more and more are relying on intravenous pirustrin; while there are still others, moved by this fear, who have turned to spinal or local anæsthesia.

b. By Comparison.—In 83 operations under ether Bohler and Reiles experienced a notable degree of atony in 23·5 per cent. In 43 operations under spinal anæsthesia atonic bleeding occurred in only 8·2 per cent. Andérodias reports abnormal hæmorrhage in 4 out of every 7 cases operated on under general anæsthesia, and contrasts this with an incidence of 1 in 20 when spinal anæsthesia was employed. Pomini, who encountered considerable hæmorrhage in 9 out of 39 cases, maintains that its occurrence is much less frequent with spinal anæsthesia.

These comparative experiences completely reflect my own, not only in abdominal section but in all forms of operative delivery. It has been my practice with few exceptions to omit oxytocic injections until their use was strictly called for. Their help was required more than four times as frequently for the patients operated on under ether as for those delivered under local or spinal anæsthesia. Phaneuf, whose experience of this operation is almost unrivalled, has no doubt

whatever on this matter "Ether," he writes, "causes relaxation of the uterine muscle, and in my experience causes more bleeding than any other type of anæsthesia"

J B Pastore, in his inquiry into blood-loss in the third stage of labour, regards anæsthesia as a possible factor in the cause of partial separation of the placenta and uterine atony. There can at least be no doubt that when the lower segment operation is performed under ether, the onset of firm retraction is delayed, the placental stage is usually prolonged, manual delivery is frequently necessary, and the amount of blood lost, always definitely increased, may on rare occasions prove to be fatal.

c In Recorded Fatalities—Gueniot mentions that, of 29 deaths, 4 were due to atony and hæmorrhage. Le Lorier, Dujol, Balard and Gueniot, Mayer, Kurig, and Ginglinger are a few who have openly lamented deaths from this cause. "Our fatality occurred before we adopted spinal anæsthesia which removes this danger" (Balard). Durst encountered hæmorrhage of such severity under ether anæsthesia that hysterectomy was required in 4 patients, one of these died. But it is very likely (indeed it is true), as Gueniot has suggested, that such cases only rarely find their way into the literature. Not all the fatalities were necessarily ascribed by these writers to the form of anæsthesia employed. But judged in the light of experience, I am forced to conclude this was a very potent factor. Von Ammon in his statistical inquiry of 1930 appears to have been similarly impressed. "Atony deaths were as common as those due to cardiac insufficiency and anæsthetic misadventures." In his opinion death from hæmorrhage was to be ascribed to rapid emptying of the uterus, anæsthesia, and, when hysterectomy was required, to the increased shock of the operation.

Of the 20 deaths following Cæsarean section in the Liverpool Maternity Hospital since 1932, 3 were definitely the result of uterine atony and hæmorrhage. Two followed the lower segment operation, one the classical—all were performed under ether. In a fourth case in which ether-gas-oxygen was used, the loss of blood was sufficient to warrant transfusion. As heart disease was the indication, hæmorrhage alone cannot be blamed for this death. There was another death from hæmorrhage, this occurred within a few hours of Cæsarean section performed under spinal anæsthesia for central placenta prævia. But in this instance the lower segment was proved to be pathological (*Fig 85*)

To those who practise the classical operation this may appear to give an exaggerated conception of the question. But the circumstances are not exactly comparable: first, the lower segment operation requires more time and also more anæsthetic; second, the latter operation is so often employed late in labour and in those cases in which uterine inertia has already been a predominant feature. I believe it was partly for these reasons that Burger was led to assume that a tendency to uterine atony was almost a characteristic of the lower operation.

2. Effect on Metabolism.—The time of operation cannot always be foreseen. Labour may be advanced, intake of food and fluids disturbed, rest and sleep inadequate, and vomiting troublesome. Fuss and Derra, Pride, Schmitt, Sebenig, and Schultze, to mention only a few, have all demonstrated the adverse effects of general anæsthesia on metabolic processes. Some degree of acidosis is invariably induced by ether anæsthesia, and if this is already present to a degree, as Pride has proved is frequently the case when labour is prolonged, then the anæsthetic can only exacerbate the condition. Post-operative vomiting, meteorism, dilatation of the stomach, and ileus are occasional sequelæ.

3. Toxic Effects.—In pregnant women the liver and kidneys are particularly susceptible to noxious influences. If Cæsarean section is performed under general anæsthesia on patients in whom there is evidence of disease in these organs, if consciousness is not regained but after a period of coma death finally supervenes, then from a comparative experience of the good results in similar patients operated on under local or spinal methods, I feel compelled to attribute the fatality not to the operation but to anæsthesia. Of the 20 deaths alluded to above 2 may reasonably fall in this category.

4. Influence on Bowel and Peritoneum.—Finsterer has brought forward clinical evidence that ether anæsthesia lowers the resistance of the peritoneum. Pierce urges the same view. Geller regards its effect on the intestinal functions as harmful and depressant. As the peritoneum is often put to a severe test in Cæsarean section, and ileus and peritonitis are not uncommon causes of death, these views cannot be entirely disregarded.

5. Fœtal Asphyxia.—After ether anæsthesia infants are not infrequently born in a condition of asphyxia, but this is usually of brief duration and of no particular moment if the child is mature. But when Cæsarean section has to be undertaken in the face of

prematurity or because of fetal distress, this initial setback may modify the infant's chances of survival

SAFEGUARDS AGAINST THE DANGERS OF ETHER

The following rules should be observed —

1 Induction should not be commenced until surgeon and assistant are fully gowned and gloved and everything is in readiness to make the abdominal incision

2 Unfortunately Cæsarean section must often be performed without regard to the time or size of the latest meal Induction should be conducted with the greatest care to avoid retching or vomiting I have known two patients during the last few years in whom this was presumably the cause of a bronchopneumonia Both developed an empyema and both recovered In a case recorded by Blakley the bronchopneumonia terminated fatally

3 If an expert anæsthetist is available nitrous oxide should, in a large measure, replace the ether This gas has no unfavourable effects on uterine retraction

4 Oxytocic preparations should always be employed The most effective routes of injection are the intravenous and the intra-uterine

5 The delivery should be conducted in the way outlined in Chapter VII

6 Intra-uterine packing must be resorted to early if retraction is delayed or hæmorrhage at all excessive The anæsthetized patient can succumb to a loss of blood which the conscious woman will easily support

7 Ether should at least be avoided in all patients for whom the indications for the operation are medical It is particularly contra-indicated when the lower segment operation is performed for placenta prævia I believe it to be entirely unsuitable for patients in whom inertia has been a leading feature of the labour

Schulcz has bluntly stated that deaths after Cæsarean section are due either to infection or anæsthesia This deserves a high place among obstetrical aphorisms

SPINAL ANÆSTHESIA

" A mon avis, les inconvénients de la Rachi se réduisent à un seul, majeur à la vérité, à savoir le danger de syncopes mortelles "
(VORON)

With the effect of ether on the uterus the action of spinal anæsthesia stands in sharp and unmistakable contrast Doleris was the

first to draw attention to its positive influence on uterine contraction (Preissecker), and since that time a long succession of operators have confirmed and enlarged upon the observations of this early pioneer. It is this quality that makes its selection for the lower segment operation, if not always a happy, at least a particularly attractive choice.

Of its service in this operation it may be said at once:—

1. Spinal anæsthesia offers pronounced advantages to the mother.
2. Its use does not appear to endanger the infant.
3. Spinal anæsthesia in Cæsarean section appears to have been followed by a higher *direct* mortality than has attended its use in other pelvic operations.
4. If the dose is strictly limited and attention is directed to certain details of technique, *most* of its dangers can apparently be averted.
5. There are contra-indications to its use in this operation.

I. ADVANTAGES TO THE MOTHER

1. **Diminished Hæmorrhage.**—This is the most outstanding feature of the operation when performed under spinal anæsthesia. The practical consequences are:—

Operative.—Audébert has said: “On opère à blanc.” The operation is rendered easy and elegant (Brindeau). The uterine wound can be extended with safety and precision. Suturing is carried out while the organ is in a state of maximal retraction and the edges of the incision are quite anæmic. Increased solidarity of the union results, with all its advantages, immediate and remote.

Third Stage of Delivery.—Manual removal of the placenta with its attendant dangers of increased loss of blood and infection is rarely called for. Atony does not arise and delayed hæmorrhage is an unusual complication. According to Rismondo spinal anæsthesia must be reckoned among the oxytocic drugs. Brindeau in his last 100 operations (no maternal mortality) noted “slight hæmorrhage” in only 6 cases.

Puerperium and Morbidity.—Immediate closure of the uterine sinuses and sustained retraction with a minimal loss of blood are the preliminary requisites for an afebrile puerperium (Hanisch, Siegert). In Siegert's experience the incidence of morbidity of genital origo was only half that of cases operated on under general anæsthesia. Preissecker experienced a complete absence of puerperal thrombophlebitis when obstetric operations were performed under spinal

anæsthesia Others have not been so fortunate, but at all events the frequency of this complication seems to be reduced

2. Effects on Metabolism, Liver, and Kidneys—These are negligible It may safely be used, therefore, in patients in whom these organs are diseased and in whom general anæsthesia might possibly prove fatal The experience of Cosgrove and others leaves no room for doubt on this point

Compared with the figures found after chloroform and ether, the blood lactic acid is raised only to a slight degree (Priessecker), and elevation is due rather to the circulatory changes induced by spinal anæsthesia than to any general action it has as a tissue poison or cellular depressant This effect can be prevented by the use of icoral, ephedrine, or the free administration of CO₂ and O₂ (Priessecker)

3 Effects on the Intestinal Tract.—Some years ago Wagner drew attention to the dynamic effects of spinal anæsthesia on bowel peristalsis Mayer, Bunne, and others have recorded similar clinical experiences, while more recently Biancalana and Borsotti, as a result of animal experimentation, have brought forward evidence on this point which is incontrovertible Geller believes that a part of the lowered mortality in Cæsarean section under spinal anæsthesia must be attributed to its action in this direction Post operative vomiting is rare, and intestinal atony, meteorism, and ileus are all quite uncommon in the early puerperium

Brindeau has truly summed up the post-operative course in these patients "*Les suites opératoires sont sans histoire*"

II EFFECT ON THE INFANT

The literature offers little information concerning the comparative merits of inhalation and spinal anæsthesia in relation to the infant But what has appeared seems to be in favour of the latter method Kawaguchi found in cases delivered under spinal anæsthesia that 23.6 per cent of infants presented some degree of asphyxia When section was performed under ether the asphyxia rate was 50 per cent Puppel reports an even greater difference, for spinal anæsthesia 16.6 per cent for ether chloroform mixture (8.2) 60.4 per cent

Siebert, in 191 Cæsarean sections under spinal anæsthesia, had a foetal mortality of 2.1 per cent No foetal death could possibly be attributed to the anæsthetic Priessecker mentions in his monograph a foetal mortality of 2.67 per cent in 150 cases, while 632 sections in ether anæsthesia gave a foetal mortality of 8.22 per cent Eisenberger

has had considerable experience in dealing with late infected cases (p. 130) in which the fetal heart tones were barely audible and the infants clearly suffering from intra-uterine asphyxia. Spinal anaesthesia, he writes, has enabled him to save many of these babies; ether always increased his anxieties, and artificial respiration was frequently necessary. Brault and a few others have regarded the exaggerated uterine tone as a possible cause of fetal embarrassment. Against this, however, can be placed the immense experience of Cosgrove. In over 1700 vaginal deliveries under spinal anaesthesia no such ill effects could be observed.

All these good points deserve to be remembered while the less satisfactory aspects of spinal anaesthesia are being considered. If they are sometimes presented too warmly by enthusiastic protagonists, it is equally fair to state that they are often deliberately overlooked by the many who oppose its use in this operation.

III. THE PECULIAR SUSCEPTIBILITY TO SPINAL ANÆSTHESIA OF WOMEN UNDERGOING CÆSAREAN SECTION

"It must nevertheless be admitted that the percentage of fatalities in pregnant women is higher than that in non-gravid patients—indeed, as a result of frequent and unpleasant occurrences, the use of spinal anaesthesia has in many places been entirely given up" (Preissecker, 1934). Von Jaschke and many others agree that the pregnant state renders the woman particularly sensitive to the effects of spinal anaesthesia. Sebrechts includes pregnancy in the same category as certain toxic states (jaundice, uræmia, ileus, cachexia of carcinoma) which enhance the dangers of these drugs. These and similar views have recently received substantial support in the several papers by Franken, upon which I have freely drawn for much of the material in this section.

This worker found that in approximately 2000 sections performed by 20 operators, 14 deaths were attributable to the spinal anaesthetic alone. The combined experiences of Sussmann, von Jaschke, and Mayer embraced some 12,000 anaesthetics; there were 4 deaths, all in Cæsarean sections.

In Franken's own clinic 1000 gynaecological operations under spinal anaesthesia passed off without anaesthetic misadventure; the first patient subjected to Cæsarean section died as a direct result of the injection. Katz ("Death in Narcosis and Spinal Anaesthesia in Gynaecological Operations") discusses in full the 21 deaths which

supervened when the latter method was used. Four of these followed Cæsarean section, and in one of them certainly, and very probably in another, death was directly associated with the anæsthetic. Even this was far too high a mortality for any one operation.

Apart from the above I have been able to gather an additional 28 fatalities from the very recent literature. Durst, 1, Boschhoff, 1, Camargo, 1, Fotie, 1, Keller and Bohler, 1, Kreis, 1, Pery, 1, Orth, 1, Lienhoop, 1, Barjaktorović, 2, Elmendorff, 2, Kurig, 1, Brochier, 1, Cotte, 1, Feiner, 1, Klaus, 4, Fairfield, 3, Leon, 1, Casalta, 1, Cambon, 2.

Durst experienced no death due to the procedure in more than 4000 gynæcological operations. Lienhoop's patient was 24 years of age, and the only death due to the anæsthetic in more than 600 operations of a widely varying nature. But there is no need to dwell on this sinister list. Nothing can lend more striking emphasis to the dangers of this method than Stoeckel's (1938) cryptic account of his own results with spinal anæsthesia in Cæsarean section, "two deaths in Kiel, two deaths in Berlin, all following directly upon the injection."

Such hypersensitivity towards these drugs has been accounted for in many ways —

- 1 The threshold of permeability of the capillary endothelium is lowered during pregnancy. Preissecker considers that this favours the entry into the circulation of substances injected intrathecally. Administration of calcium over a few days seemed to confer a heightened resistance to the undesirable effects of spinal anæsthesia.

- 2 Von Jaschke saw a connection between the existing lipoidæmia and the increased toxicity of spinal anæsthetic solutions during pregnancy (Franken).

- 3 The volume of blood diverted to the generative organs in pregnancy is greatly increased. The action of spinal anæsthesia is to shift a further quantity into the splanchnic circulation and the lower limbs, the venous return is thus diminished, the stroke volume of the heart reduced, and the vital centres are exposed to the dangers of anoxæmia. Shimotsuma, Waters and Leavitt, Dieter, and quite a number of others hold that it is mainly in this indirect way that respiratory and vasomotor paralysis is brought about in the majority of those cases which show symptoms of collapse or terminate fatally.

- 4 Pankow some years ago expressed the view that the presence of labour pains was inimical to the safe working of spinal anæsthesia. Franken is now the chief exponent of this belief, and explains their

unfavourable effects in the following way: Uterine contractions cause little change in the intrathecal pressure. He has, however, clearly demonstrated by manometric experiments that the pressure of the cerebrospinal fluid is considerably raised when the pains of labour are associated with crying out, marked restlessness, or bearing down efforts. Now Hartwich has proved that *similar efforts or emotional disturbances in children bring about similar pressure changes*; as a result, solutions injected into the lumbar canal were rapidly translated to, and could be readily recovered from, the cisterna magna. Proceeding by analogy Franken supposes that this is what occurs in the labouring woman; and as Hartwich found that the rate of ascent was greatly retarded by a preliminary dose of morphia, so Franken would suggest that in such patients spinal anæsthesia (if used at all) should be preceded by hypodermic injections of this drug.

My own experience leaves me in no doubt that spinal anæsthesia is particularly dangerous in Cæsarean section. On three occasions I have encountered severe degrees of collapse; in another patient breathing ceased, the pulse was imperceptible, and for some moments I acted on the presumption that she was dead. On several other occasions the condition of the patient caused me considerable anxiety and brought the operation to a temporary standstill. Only one of these women was in labour at the time of operation, and in all instances only the *minimal dose* had been injected.

From some of the figures which have been available for the preparation of this section at least one irrefutable conclusion can be drawn: *Any obstetrician who sets out to perform a large series of Cæsarean sections under spinal anæsthesia must be prepared to face a possible mortality of not less than 1 per cent due to this cause alone.*

IV. THE WAYS IN WHICH SPINAL ANÆSTHESIA MAY BE MADE SAFER IN CÆSAREAN SECTION

1. Pre-operative Medication.—Morphine, hyoscine, and all respiratory depressants are dangerous and should be omitted (Preisseecker, Mayer, Thiessen). The two patients in whom the most alarming degrees of collapse occurred were among the very few whom I had prepared with these drugs. I am therefore unable to subscribe to Franken's recommendation in this matter, and would always prefer some other form of anæsthesia for the type of patient to which he refers.

2. The Dose.—This must be as small as possible. Half the quantity ordinarily employed in gynecological operations will generally

be found sufficient Von Jaschke, Preissecker, Thiessen, Cosgrove, and Sebrechts have all emphasized the importance of this precaution Hollenbach has found that, for many surgical procedures, the dose injected need be only one-third of that formerly thought to be necessary The quantities put up by manufacturers are certainly always in excess of that required for the lower segment operation The solution of stavaine, the drug I have most frequently employed, is supplied in 2 c c ampoules Only on two occasions have I used more than 1 c c , in fact, the quantity injected in the great majority of instances has not exceeded 0.8 c c Thus any surgeon employing spinal anaesthesia will do well to determine early the minimal dose of his preparation with which he can produce for a period of forty-five minutes anaesthesia which need not extend higher than the umbilicus

3. Circulatory Stimulants.—Ephedrine given some 15 to 30 minutes before the spinal injection will do much to prevent an immoderate fall in blood-pressure Thiessen, on the other hand, has demonstrated that a stronger and more sustained effect can be obtained from the intramuscular injection of 2 c c of icoral There are, however, widely divergent views as to the best way of guarding against circulatory collapse Dieter, who incidentally regards Caesarean section as a contra-indication to spinal anaesthesia, gives cardiazol-ephedrine, 1 c c can be given intramuscularly twice daily for a few days, and again immediately before the operation

4. Level of Injection.—This should never be higher than the space between the third and fourth lumbar vertebrae I followed Preissecker, and always chose the space below this

5. Direction of Injection.—The bevel of the needle should be directed downwards, the risk of the solution ascending unnecessarily high is thus said to be reduced

6. Carbon Dioxide and Oxygen.—Apparatus for the administration of CO_2 (5 per cent) and O_2 should always be at hand A few inspirations of this mixture will nearly always abolish nausea and vomiting should these appear It also has a tonic effect on the circulation

7. Slow Delivery of the Infant (p 135)—The experience of Cosgrove and others would make it appear that vaginal are conducted with much greater safety than abdominal deliveries I have always felt that slow and gentle extraction of the infant is a factor in preventing sudden circulatory disturbances This conviction is confirmed by Barjaktorović, who specifically stresses this point

8. Collapse.—If this occurs before the delivery of the infant, there is a very natural tendency to speed up the operation and hasten its extraction. The surgeon can commit no greater error; not until the pulse has improved, the respirations have increased in depth and frequency, and vomiting has ceased, should the operation be proceeded with.

Innumerable recommendations have been made for dealing with this condition. I confine myself here to the course I have invariably adopted. The patient is immediately placed in a steep Trendelenburg position and CO_2 and O_2 are administered through a mask. Circulatory stimulants are injected, and an intravenous infusion of saline (to which adrenaline may be added) is begun if recovery is not rapid. Despite the fact that I have always used a 'heavy' anæsthetic, the above procedure has so far produced excellent results. Once recovery has set in it is always progressive and a relapse need not be feared.

V. CONTRA-INDICATIONS TO SPINAL ANÆSTHESIA

Heart Disease.—There is a general consensus of opinion among those who have written on the wider applications of this method, that spinal anæsthesia is inadvisable in any patient suffering from myocardial disability. Priessecker, Thiessen, and Schäfer are strongly against its use when Cæsarean section is being performed on this indication. This attitude is understandable. Abrupt circulatory changes may quickly follow the injection. To these the normal heart will in most cases easily readjust itself. It hardly seems rational, however, to expect the same response from a muscle which is already functioning imperfectly.

Burns, Tausch, and a few others have reported small series of cardiac patients who have successfully supported this anæsthetic; and I have been able to collect almost fifty such cases from the records of the Liverpool Maternity Hospital in which spinal anæsthesia has been used without fatality. Nevertheless, it must be recorded here that on a recent occasion death occurred suddenly immediately after extraction of the infant. The patient was suffering from mitral stenosis, with apparently good myocardial compensation.

In my own practice I have been swayed by the theoretical objections rather than by clinical results. Spinal anæsthesia has admittedly been used in a few cases, but in all these good compensation was present, and the operation undertaken as much for the purpose of sterilization as to avoid the dangers of labour. For a long

time now nothing but local anæsthesia has been used for all such patients, whatever the degree of myocardial disability ,

Severely Shocked or Apparently Moribund Patients.—If urgent intervention is necessary only local anæsthesia is permissible

Severe Degrees of Anæmia.—My own experience compels me to agree with Preissecker that a *moderate* grade of anæmia, especially if this has resulted from placenta prævia, does not *necessarily* preclude the use of spinal anæsthesia Its action on uterine retraction has, according to many writers, made its use particularly valuable in this condition A further reduction in the dosage will often be found possible in the anæmic woman

Systolic Blood-pressure below 105 mm. Hg from any Cause.—Many who practise the method agree with this contra indication Again it need not be regarded as an *absolute* rule provided the dosage of the drug is small Cosgrove has shown that when the initial blood-pressure is low the further fall from the spinal anæsthesia is comparatively slight

Nervous and Emotional Patients.—Experience has shown that these women are liable to react to spinal anæsthesia in a very uncertain manner They are more commonly met amongst those undergoing an elective operation

Generally Debilitated and Cachectic Women and Hypotonic Types—These are not considered favourable subjects for spinal anæsthesia

RESULTS

Comparable statistics showing the results of spinal and general anæsthesia in the lower segment operation are few They do, however, support the impression that, despite the occasional death which must inevitably result from its use, spinal anæsthesia will still yield better total results than the ordinary inhalation methods

Geller published the table at the top of p 70 To it I append the results obtained over a period of almost five years in the Liverpool Maternity Hospital They concern only conservative classical or lower segment operations

As regards our own results, it can be said that the spinal anæsthetic group included the great majority of those patients who for one reason or another were regarded as "poor risks"

Unfortunately fatalities from spinal anæsthesia are sudden and dramatic, and the relation between cause and effect is so obvious

RECORDER	GENERAL ANÆSTHESIA		SPINAL ANÆSTHESIA	
	No of Cases	Reduced Mortality	No of Cases	Reduced Mortality
		per cent		per cent
Siebert	—	—	191	1·3
Preissecker	482	3·3	150	1·3
Geller	210	3·8	71	1·4
		(Unreduced)		(Unreduced)
Liverpool Maternity Hospital (1932-1936)	488	2·2	250	1·6

that, excepting only air embolism, they cannot possibly be confused with any other form of death. On the other hand there is no such narrow connection between general anæsthesia and the dangers to which it can give rise. It is so much a matter of belief and clinical experience. A surgeon may have performed several hundred sections under ether and stoutly proclaim that he has never had an 'anæsthetic' death. Not until I am also satisfied that he has experienced no mortality from 'shock', 'cardiac failure', uterine atony, or delayed or reactionary hæmorrhage can I fully share his complacency.

LOCAL ANÆSTHESIA

"Il est certain que c'est le procédé de l'avenir, celui qui nous met à l'abri de ces accidents graves qui sont la rançon de l'absence de douleur" (CASALTA).

A few obstetricians have deliberately made this their method of choice and have employed it with considerable success in a large number of operations.

SURGEON	NO. OF CASES	MATERNAL MORTALITY
		per cent
Daily (Chicago Lying-in Hospital), 1935 ..	500	1
Frey (Zurich), 1928	280	5·7
Pierce (California), 1931	152	1·31
Williamson, 1931	52	0
Schulcz (Budapest), 1927-33, 1933	132	0
Greenhill (Chicago Lying-in Hospital), 1931 ..	117	0
DeLee, 1925	330	0·6
Feldweg, 1936	74	0

As yet, however, the majority are not prepared to go so far as these surgeons, and reserve local infiltration anæsthesia for those very

ill women who are unable to withstand more than the minimum of anæsthetic and operative shock

LOCAL ANÆSTHESIA IN ABDOMINAL SURGERY

An attitude of scepticism or indifference towards the possibilities of this method in abdominal surgery can no longer be justified. Finsterer, an acknowledged authority, has reviewed his experience of more than 5000 abdominal operations performed chiefly under local anæsthesia. A great number of these operations was carried out on stomach, colon, or rectum—procedures which demand deep and long-continued narcosis. The mortality-rate from circulatory or cardiac failure during the three days immediately following operation was only 0.08 per cent. During a period of years in which general anæsthesia was employed the death-rate from similar causes was as high as 2.2 per cent. In the series operated on under local anæsthesia, post-operative peritonitis was a rare occurrence, and ileus was a very unusual development. Prolonged ether anæsthesia, in the opinion of this surgeon, seemed to prepare the ground for a rapidly spreading peritonitis even when the peritoneum had suffered only the lightest contamination.

Pneumonia *did* occur after operations under local anæsthesia, but its incidence was lower (0.24 per cent as against 1.31 per cent for general anæsthesia), it ran a more benign course, and was rarely fatal. Deaths from pulmonary embolism were four times more common in patients subjected to ether. It is true that in some 30 per cent of his cases the local anæsthetic had to be supplemented by ether. But so long as this did not exceed 100 c.c. its effect on the post-operative course was barely noticeable.

In this country Ogilvie, Bankoff, Davis, and Edwards have recently extended the use of local anæsthesia to many of their abdominal cases, and have drawn attention to the absence of shock and the smoother convalescence that ensues.

Pelvic surgery readily lends itself to this method. The site of a midline incision is easily anæsthetized. The prevertebral and presacral plexuses are accessible to injection, or the discomfort accompanying traction on the uterus or the adnexa can be abolished by infiltrating the broad ligaments. Backay found pulmonary complications rare, and 'anæsthetic shock' absent. His conclusions, arrived at from a study of some thousands of cases, are very similar to those of Finsterer.

LOCAL ANÆSTHESIA IN CÆSAREAN SECTION

Advantages.—DeLee, Greenhill, Pierce, and Frey have all elaborated the benefits which local anæsthesia confers on patients subjected to Cæsarean section.

1. Absence of operative 'shock'. Even in my own small experience I have been able to observe how essentially 'operative shock' or disturbance is actually 'anæsthetic shock'. The well-being of these patients throughout and immediately after the operation is quite remarkable. Thirst is not complained of; vomiting and sweating are absent; the colour remains good; the pulse is frequently under 80, and its quality excellent. The blood-pressure is practically unaltered.

2. Pulmonary complications are rare. DeLee (1934) declared: "We have never had pneumonia, bronchitis, or œdema of the lungs following anæsthesia unless the patient was operated on under local anæsthesia because of the existence of a bronchitis or pneumonia". Neither Pierce nor Frey experienced pneumonia in their series.

3. Novocain is without injurious effects on liver or kidneys. This fact at once emerges from Daily's series of cases (p. 70), in which some 8 per cent were operated upon for toxæmia or even eclampsia. Included among Feldweg's smaller number there were six patients suffering from eclampsia.

4. The heart muscle is entirely spared. The way in which women with severe degrees of cardiac decompensation will tolerate Cæsarean section under local anæsthesia has convinced me that this is the most suitable form of delivery for all such cases.

5. Gastric and intestinal motility remain unimpaired. Pierce experienced only three cases of abdominal distension; in only one was it extreme. In more than 80 sections (classical and segmental) under local anæsthesia I have seen this occur only once, and then in a moderate degree.

6. There is no interference with uterine retraction. Consequently there is a striking reduction in bleeding. Deaths from uterine atony are not reported when this anæsthetic is used. In Frey's large series of operations no occasion arose on which it was necessary to pack the uterus. Even moderate degrees of atony were rarely encountered. As with spinal anæsthesia, the need for oxytocic injections is seldom apparent.

7. The infants are born 'fresh', and asphyxia is not encountered (Frey). This is certainly true if pre-operative medication is omitted.

The surgeon who has used local anæsthesia can leave the theatre with an easy conscience and a quiet mind. His patient has not run the anæsthetic gauntlet—ether and hæmorrhage on the one hand, the tragic risks of spinal anæsthesia on the other. Indeed he finds it hard to believe that he has placed her in the slightest jeopardy. And at what sacrifice? A little less hurry, a little more care and trouble.

Technique.—In comparison with the abdominal surgeon and the gynæcologist the obstetrician is at once beset with two minor

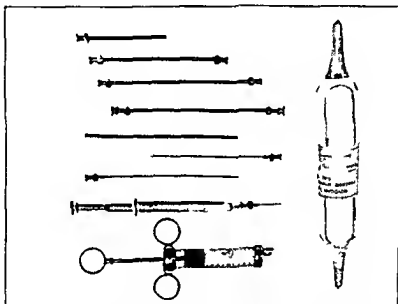


Fig 37—Labat's syringes and needles. The novocain (0.50 per cent) is supplied in sterile ampoules of 100 and 50 c c.

drawbacks. (1) Because of the presence of the infant pre-operative sedatives cannot be administered with quite the same freedom, (2) Owing to the enlargement of the uterus the prevertebral plexuses are not accessible to abdominal infiltration. Schulcz has injected these structures by the paralumbar route—a method requiring considerable experience. It is a refinement which is quite unnecessary and not without danger.

Pre operative Sedatives—An injection of omnopon (gr $\frac{1}{3}$) with hyoscine (gr $\frac{1}{100}$) one hour before the operation has given satisfactory results. If the pregnancy is at term such a dose is without prejudice to the child. In anæmic women, however, or when the infant is premature, the amount of these drugs may be reduced,

entirely omitted, withheld until the skin is about to be incised, or given only after delivery of the infant.

Five out of every ten patients can be relied upon to sleep or at least doze throughout the operation.

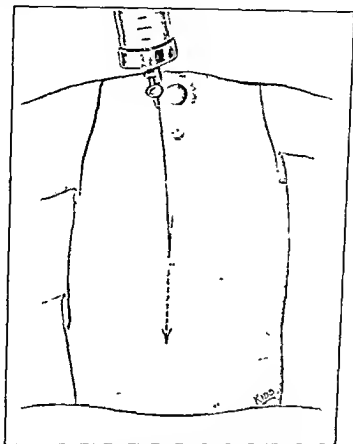


Fig. 38.—Anæsthetizing the skin.

The Anæsthetic.—Novocain or procaine (0·5 per cent) is always used. Between 200 and 300 c.c. should be available; the smaller quantity will rarely be exceeded. This amount can be given in perfect safety. I have known more than 200 c.c. of a 2 per cent solution to be used without producing more than a moderate fall in blood-pressure, pallor, and a degree of drowsiness in the patient. So far adrenaline has not been added. (Fig. 37).

Anæsthetization of the Abdominal Wall.—This has always been carried out in the theatre. The lights are dimmed and the eyes shaded.

The ears are not plugged with cotton-wool, this induces in many patients a sense of isolation and fear. When they show an inclination to sleep the operation is conducted in silence, if they persist in lying awake they are from time to time engaged in conversation.

There are many ways of anæsthetizing the abdominal wall. My colleague, C. J. K. Hamilton, and myself have now used the following technique in some 150 cases and are pleased with the resulting anæsthesia.

Infiltration of the skin and fat. Two intradermal wheals are raised with the finest hypodermic needle, one just below the umbilicus, the other midway between this point and the pubes. Through the upper one a Labat needle (10 cm.) is introduced and the tissues on the lower and lateral aspect of the umbilicus are infiltrated. The needle is now directed downwards, and keeping its point *immediately* beneath the skin and *moving* all the time, the subcutaneous tissue is injected as low as the length of the needle will permit. The needle is then withdrawn, reinserted through the lower wheal, and the process repeated. Deeper injections are then made with the needle still in the mid-line, if its point is advanced very slowly the solution will spread laterally for at least half an inch (*Fig. 38*). It is particularly important to inject all the fatty tissue in the upper part of the mons veneris.

With one clean sweep of the knife the skin and fat are immediately incised down to the rectus fascia.

Injection of the rectus sheaths: Each sheath is pierced about one inch lateral to the linea alba, and with the needle proceeding first upwards (20-30 c.c.) and then downwards (20-30 c.c.) these spaces are distended with the solution (*Fig. 39*). Twenty cubic centimetres are specially directed downwards and backwards through the lower part of the linea alba into the prevesical fat. These injections partly paralyse the muscles, anæsthetize the transversalis fascia and the parietal peritoneum, and intercept the anterior cutaneous twigs of the muscular branches of the intercostal nerves.

The abdomen is opened without pain directly through the linea alba.

The operation proceeds in the usual way. Once the Doyen is in position the subperitoneal tissue on the front of the lower segment may be injected and the solution diffused by pressure into the broad ligaments. I now dispense with this as I have found it of doubtful value.

Difficulties and Drawbacks.—

1. When the patient is awake the insertion of the gauze protection is assisted if necessary by asking her to take a few deep breaths.
2. When the head or presenting part is mobile its delivery will rarely call forth any protest. This is also true in the majority of

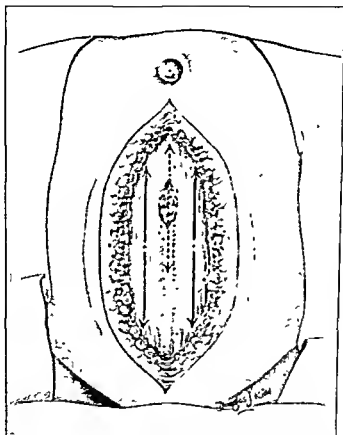


Fig. 39.—Showing method and directions of injecting the rectus sheaths.

cases even if the head is engaged, provided the uterus is not in labour or the cervix dilated. However, unless the patient is asleep, a little gas and air, gas and oxygen, or best of all a few whiffs of ethyl chloride on an open mask, need never be withheld. With DeLee and his associates ethylene has been popular when the assistance of some form of inhalation anæsthesia has seemed necessary. Lately they have been using avertin as a basal narcotic (*Daily*). Heyn prefers ethyl-chloride-ether.

3 If the head is wedged in the brim or pelvis as the result of uterine contractions, it is always desirable, if not really essential, to enlist the help of one of the above methods

4 The tone of the abdominal muscles plus the excessive retraction of the uterus may carry the uterine wound deeply behind the symphysis and make its closure a little arduous. The preliminary insertion of a traction suture is of considerable help

5 Suture of the uterovesical peritoneum, and crushing, ligation, or excision of the tubes, may all cause pain. But even to these steps women are sensitive in greatly varying degrees

Most of these are really minor disabilities and can be overcome with patience or minimized by gentleness. Speed must give way to lightness of touch. The time required for the operation under local anæsthesia varies between forty and fifty-five minutes. I was once proud of the fact that I had on several occasions assisted at classical Cæsarean sections under general anæsthesia which were completed in under ten minutes. The condition of patients delivered through the lower segment under local anæsthesia I now know to be incomparably better even on those rare occasions when the operation occupies the whole hour

OTHER ANÆSTHETICS

Ethylene, pernocton, and avertin have all been used in association with local anæsthesia. Cyclopropane, vinyl ether, and evipan are also employed in this operation, it has been said that the first and second of these do not delay uterine retraction (Ball and Richards). In some German clinics evipan in small doses repeated throughout the operation is becoming popular. But the information concerning most of these methods or their combinations is meagre and does not warrant consideration at the present moment

CONCLUSION

It is my purely personal opinion that during the last six years in the Liverpool Maternity Hospital 6 deaths have occurred in conservative Cæsarean section for which the anæsthetic was mainly responsible (ether 5, spinal 1), that is, almost one-third of the total mortality can be attributed to this cause

Ginglinger, in a short but extremely important note on the same subject, has offered the following impressive information —

CÆSAREAN SECTIONS	ANÆSTHESIA	DEATHS	CAUSE	ANÆSTHETIC MORTALITY
237	Ether	4	Bronchopneumonia (2) Atony and hæmorrhage (2)	per cent 1.68
248	Spinal	3	Syncope following injections	1.20

Total anæsthetic mortality, 1.44 per cent.

He concludes that ether should be reserved for certain cases of great urgency, and spinal for a few patients in whom considerable technical difficulties can be foreseen. Otherwise local anæsthesia should be much more widely employed in this operation.

With these views I fully concur. Only by the persistent use of local anæsthesia can the inevitable fatality be indefinitely deferred.

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An important article on local anæsthesia by J. FRIGYESI has just appeared in the *Journal of Obstetrics and Gynecology of the British Empire*, 1939, xli, 91.

CHAPTER IV

THE LOWER UTERINE SEGMENT OPERATION

It will be convenient to describe in turn —

I *The Transverse Operation*—(A) When the foetal head is mobile, (B) When a segment of the head is fixed in the brim or firmly wedged in the upper part of the pelvis

II *The Longitudinal Operation*—(Illustrated by a description of the procedure when the breech is presenting)

III *The Conduct of the Third Stage*

IV *The Closure of the Uterine Wound and Restoration of the Uterovesical Peritoneum*

V *The Closure of the Abdominal Incision*

VI *Repeated Cæsarean Section*

I. THE TRANSVERSE OPERATION

This method I have come to regard with the utmost confidence. It is easily carried out, almost bloodless in execution, and has, in a large series of cases, given eminently satisfactory results. In essence it aims at delivering the infant through a transverse slightly curved incision placed deeply in the front of the lower segment, or actually in the cervix if the patient is operated on late in labour.

Though I am constantly varying my own technique, the method now to be described is the one I should seriously recommend to anyone making his first acquaintance with the operation.

Instruments—The following special instruments are useful —

1 Doyen's abdominal retractor. One of the smaller sizes is employed when the operation is performed under local anæsthesia.

2 Scalp forceps. Willett's, or the type devised by Gauss of Wurzburg.

3 Bonney's modification of the Reverdin needle. It is an admirable instrument for suturing the uterus.

4 A fully curved eyeless needle carrying fine ultra-tanned catgut. This is used for the suture of the uterovesical peritoneum. It passes smoothly without catching—an advantage when one is operating under local anæsthesia.

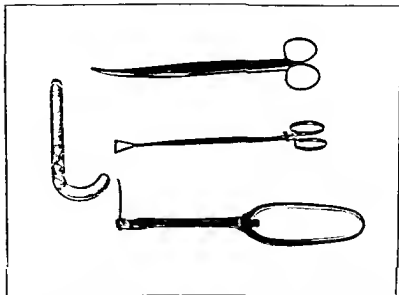


Fig. 40.—Curved eyeless needle and suture in sealed tube, curved Mayo scissors, Duval's forceps (useful for recovering the lower edge of the uterine wound after delivery), Bonney-Reverdin needle

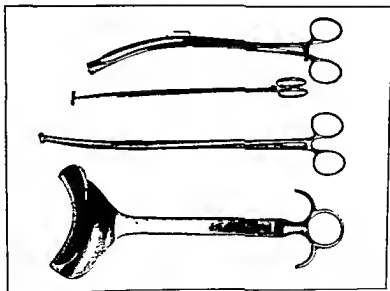


Fig. 41.—Gauss scalp forceps, small Willett's forceps in frontal view, long Willett's in profile, Doyen's retractor

1 THE OPERATION AS CARRIED OUT IN CASES IN WHICH THE HEAD IS MOBILE

The Incision—Nothing can be less in the patient's interests than a niggardly incision. A free opening, on the other hand, permits of the greatest gentleness, and allows easy retraction without undue pressure on the edges of the wound. The skin is incised in the midline (the linea nigra if it is evident) from a point a little below the umbilicus to the upper limit of the mons veneris. The linea alba is exposed, and the wound deepened through the upper part of this structure until the peritoneum is reached. Towels can now be applied to the skin edges. The peritoneum is always opened at a point nearer to the upper than the lower angle of the wound. The incision of the peritoneum and fascia is continued first upwards and then downwards, care being taken in the latter step not to involve the fundus of the bladder. If this is considerably elevated the division of the peritoneum will terminate about one inch above its reflection backwards on to the organ. The fascia, however, should be divided almost as low as its insertion into the upper part of the symphysis. In a woman who has borne children the upper two-thirds of the incision can frequently be made without entering either rectus sheath. In the primigravida, owing to the narrower linea alba, this is rarely possible.

Isolation and Exposure of the Lower Segment—The Doyen retractor is inserted and the bladder, if elevated, is drawn out of sight below the upper border of the symphysis pubis. For isolating the field of operation a roll of gauze 6 in. in width is used which has been wrung out of warm saline solution. The left iliac fossa is first lightly packed and the insertion of the gauze between the uterus and the abdominal wall is then continued all the way round to the right iliac fossa. Its end, to which a pair of artery forceps is attached, is finally drawn out over the upper angle of the wound.

Transverse Division of the Uterovesical Fold of Peritoneum—The pressure of the Doyen retractor against the lower segment is now slightly relaxed and a ridge of bladder is allowed to escape from under the edge of its speculum. In the midline, immediately above this elevation the loose peritoneum of the lower segment is picked up in dissecting forceps and opened with a snip of the scissors. Through this small opening the closed blades are passed towards the left and the peritoneum is thus raised from the uterus as far as the lateral border of the organ. The scissors are partly opened and then

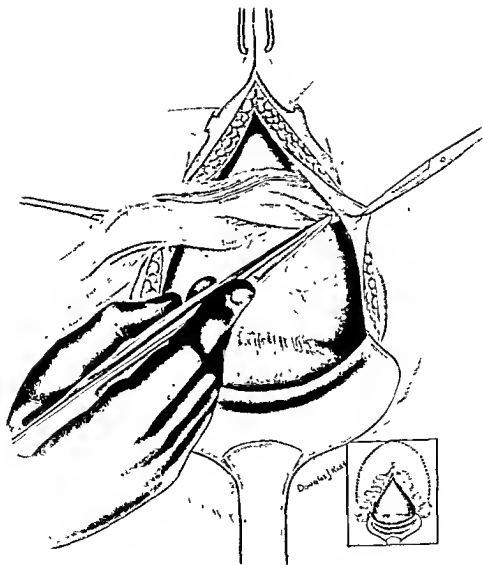


Fig. 42.—Insertion of gauze protection.

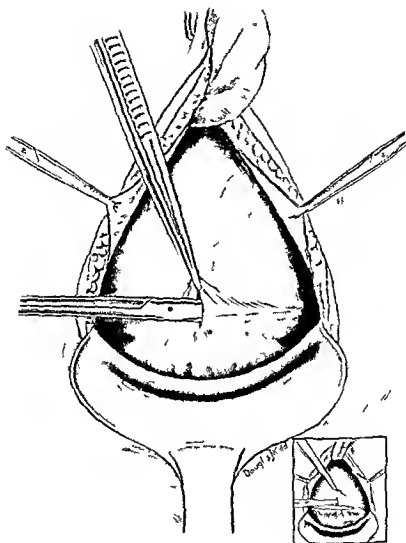


Fig 43—Supporting raising and division of uterovesical peritoneum

withdrawn. This is now repeated on the right side. One blade next inserted between the peritoneum and the uterus and the uterine vesical fold is divided first away from and then towards the operation.

Downward Displacement of the Bladder.—In all cases it has been my practice to displace this organ downwards and to incise the uterine wall at a level which, at least when the operation is complete, will be truly retrovesical. I have always felt, though this is not a universal view, that the observance of such a precaution confers upon the operation an additional degree of safety. Much importance is attached to the manner in which the bladder is displaced. A pair of Spencer Wells forceps is placed on the lower edge of the upper flap of peritoneum and the retractor is removed. The tips of the fingers, protected by a folded swab, are now firmly applied to the lower segment. Then by a firm flexion movement, *the pressure being directed against the uterus*, the bladder is wiped downwards and the swab is left in position on top of it.

Provided the head is not too firmly fixed in the brim it is not dislodged by passing the fingers of the left hand between it and the pelvic wall. With the right hand the Doyen is replaced and the head is at once prevented from sinking back into the pelvic inlet by the rim of its speculum. In the majority of cases the head is of course completely mobile above the pelvic inlet.

Transverse Incision of the Lower Segment.—With short strokes of the knife an incision not more than 1 in. in length is carefully made in the lower segment, the uterine wall meantime being drawn up, stretched, and compressed against the underlying head with the fingers of the left hand. As soon as the amniotic cavity has been entered, a small ridge of hairy scalp is raised with dissecting forceps, and to this the special scalp forceps is applied. Further escape of liquor amnii is thus immediately controlled. Advantage is now taken of the elasticity which is a noticeable feature of this segment of the uterus. By holding the forceps in the left hand almost vertically but with a slight inclination towards the head of the patient, the initial incision is raised out of the pelvis and the anterior wall of the uterus, tautly stretched over the presenting part, is brought more prominently into the wound. The incision is now extended with the scissors in a slightly upward direction first to the left and then towards the operator. Throughout this final step, if steady and moderate traction on the head is maintained, not only are the parts of the uterus more clearly defined, but the incision

can often be completed with an entire absence of bleeding. Eventually, as the wound is enlarged, more and more of the scalp appears, and after a little experience it readily becomes evident when sufficient room has been obtained to permit of the safe delivery of the head.

Delivery of the Head.—Haste is unnecessary indeed it may be positively dangerous. Unless the head is small or the infant premature, the incision is rarely quite large enough to allow of its spontaneous exit. Occasionally as the result of a pain, the administration of pituitrin, the tonus indirectly aroused by spinal anæsthesia, or light traction on the scalp forceps, it may be slowly born. In most instances, however, some form of manual assistance will be required, and here it should not be forgotten that the wound can stretch considerably before any undesirable extensions or lacerations will occur.

One or the other of the following manipulations will generally be found effective. It will usually be best to remove the Doyen first.

1 While the scalp forceps is gently drawn upon, two or more fingers of the right hand are insinuated between the head and the uterine wall and passed below the vertex. These flex the head, raise the vertex above the level of the lower edge of the incision, and form an inclined plane along which the head can be made to glide out on to the pubes. At the right moment help is offered by the assistant, who applies moderate pressure to the fundus. Sudden exit of the head should always be prevented. The scalp forceps, it should be noted, is used, not for the application of strong traction, but solely to fix, guide, and control the head, which otherwise has an unpleasant habit of slipping away or receding from the hand.

2 Sometimes there arises a moment of difficulty. The vertex is successfully raised with the fingers into the wound, but owing to the tension of the edges of the uterine incision there is not quite enough room for both the fingers and the head to be withdrawn. Here it will occasionally be helpful to employ one blade of the forceps. It is slipped in along the palm with its concavity directed forwards. When snugly behind the posterior parietal bone the fingers are withdrawn. A little fundal pressure will now slide the head out along the blade.

The head is now allowed to rest on the pubis for at least 2 minutes, and advantage is taken of this delay to wipe away any mucus from the mouth and nostrils. If the patient is under general anæsthesia an intravenous injection of $2\frac{1}{2}$ to 5 units of pituitrin should

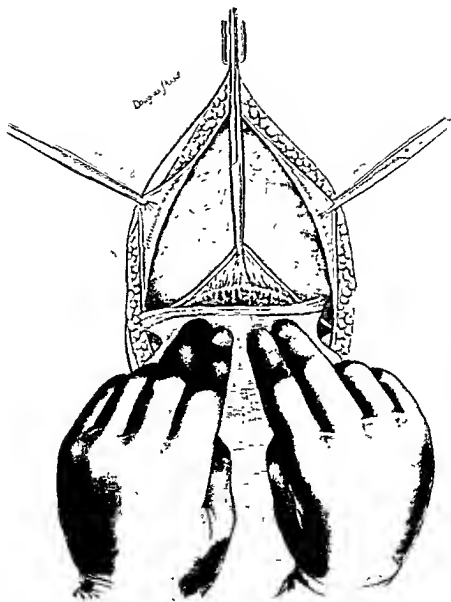


Fig. 44.—Drawing down the bladder.

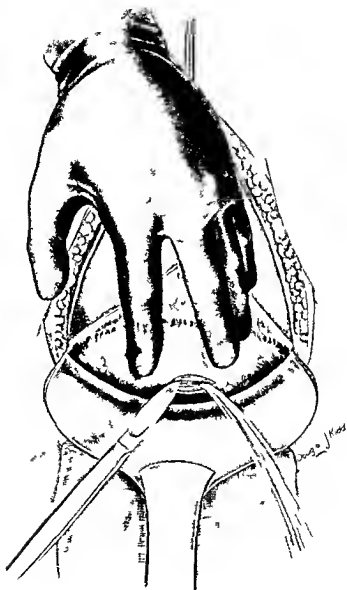


Fig. 45.—Making incision in the lower segment. The fingers of left hand draw up and spread the lower segment taut over the present no. head.

be given at this moment ; if local or spinal is being used the intra-uterine route is chosen. The extraction is then continued just as it would be at the vulva, the shoulders being delivered in turn over the lateral angles of the wound. This part of the delivery should likewise be accomplished very slowly.

As soon as the infant has been removed the membranes are wiped away from the inner aspect of the farther angle of the wound and the first suture is introduced, tied, continued for a few turns, and then laid aside until after the placenta has been expelled. The lower uterine flap, thin and perfectly flaccid, has receded deeply into the pelvis. It is drawn up (by the traction suture if this has been inserted) and everything is in readiness to proceed immediately with the rapid closure of the incision.

B THE OPERATION AS CARRIED OUT IN CASES IN WHICH A SEGMENT OF THE HEAD IS WEDGED IN THE PELVIS

We have already suggested that the operation just described should be reserved for those cases in which the head is either freely mobile, or can, once the abdomen is opened, be easily disengaged from the pelvic brim. There is a smaller, but highly important, group of patients in whom the necessity for delivery by Cæsarean section is first recognized only after labour has been in progress a considerable time. Here the conditions are somewhat different, as many hours may have elapsed since the rupture of the membranes, the cervix is partly or wholly taken up, and any degree of dilatation of the os may be present. These are circumstances which, till the moment arrives for delivering the head, are all in favour of a safe and easy execution of the different steps of the operation ; for the cervix is largely absorbed into the lower segment, and the whole of the passive section of the birth canal is greatly thinned out, increased in length and width, and markedly anæmic. Finally, the bladder has followed the excursions of the cervix and has now become, in part or whole, an abdominal organ. It is possible, then, so to place the incision that the uterus is opened through an area which is entirely retro-vesical.

It is, however, the position and the delivery of the head that are our greatest concern. A segment of the vertex may be firmly wedged in the upper part of the pelvis, grossly moulded, elongated, and not infrequently surmounted by a large caput which projects deeply into the vagina. One consequence of this is that the incision in the uterus

no longer exposes an area of the hairy scalp, but the ear and cheek, or, if the occiput is posterior, as is frequently the case, the lips or the nose are the parts which first present in the wound

To meet all these conditions the following special points should be noted —

1 In making the abdominal incision especial care must be taken to avoid any injury to the bladder

2 The Doyen draws down the bladder and the uterovesical fold of peritoneum, both of which may be considerably elevated

3 The bladder is wiped down with the greatest ease and brought to lie deeply in the retropubic space, where it is protected by a swab over which the Doyen is replaced

4 Incision of the uterus This differs from what has already been described only in the fact that it will often be possible, if labour is advanced, to place the incision actually in the cervix Additional care must be taken not to cut the child, as the thickness of the intervening tissues may not exceed a millimetre or two The wound is then extended laterally with the scissors When operating under spinal or local anæsthesia at this stage of labour, it is a very common experience for the surgeon to complete the whole incision without spilling a drop of blood It is equally true that this is believed only by those who have had repeated visual evidence of the fact

5 Delivery of the head Here there are the alternative methods
(a) *Manual delivery*, (b) *Forceps delivery*

a Manual Delivery.—It must be admitted at once that this manœuvre may sometimes present great difficulties Baulked in his immediate efforts to raise the head, the surgeon is tempted to throw all discretion to the winds This must be strongly resisted Nothing is more painful to witness than an operation, accomplished up till now with neatness and deliberation, suddenly degenerate into a fierce trial of strength between the hand and the maternal soft parts

There may be difficulty in passing the hand down within the uterus between the pelvic wall and the head, and if the vertex is markedly elongated and crowned with a large caput the fingers cannot reach sufficiently deeply to include this in their grasp The long axis of the head is usually lying in the transverse diameter of the inlet It will sometimes be found easier first to rotate the face partially to the front by placing the finger in the mouth before passing the fingers within the lower uterine flap More room will in this way

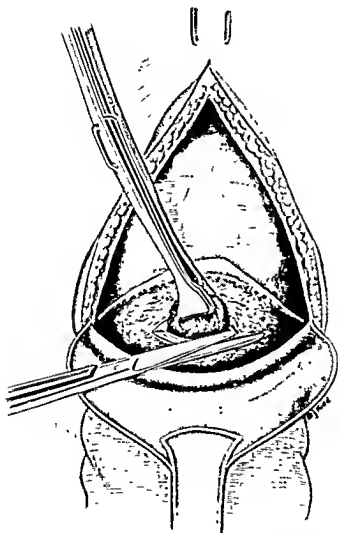


Fig. 46—Scalp forceps applied (Gauss). Hemostatic effect realized by steady traction while incision is being enlarged with the scissors. A traction suture, inserted at this moment into the lower edge of the incision, will later make the recovery of the lower uterine flap easy.

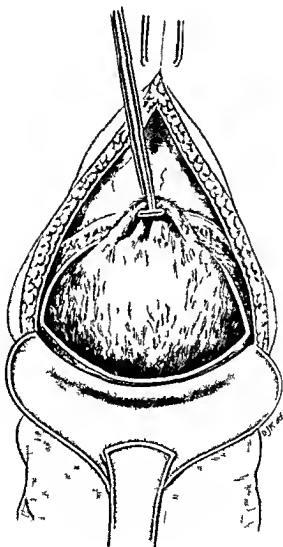


Fig. 47—Incision completed. Head about to be delivered. W. H. H. s. forceps on the scalp. We are indebted to Victor Bonney for the introduction of this instrument into the technique of the operation (see Chapter IV).

be created between the lateral pelvic wall and head. The vertex is surrounded by the fingers in much the same way as the player grasps a bowl. Flexion is brought about and the vertex and caput are gently delivered over the lower edge of the uterine wound. Sometimes the surgeon may feel on the verge of success if he could but slightly alter his grip. This he does, the head eludes his grasp, slips back into the pelvis, and the ground so hardly gained is lost. It is here that the scalp forceps is of great assistance. It should be applied as soon as an area of hairy scalp appears. Used for steadying but not for traction it greatly simplifies delivery in difficult cases.

If, however, the operator feels that too much force will be required or that the head is being compressed to an undesirable degree it is wiser to desist and resort to forceps. As a rule, if the ear, or any corresponding level of the head, presents in the wound, manual delivery will be easy. On the other hand, when the mouth or chin is the first part to appear through the incision, then it is frequently better to apply the forceps at once.

b. Forceps Delivery.—The face is rotated at least part-way towards the front. The first blade is slipped down over the more posterior cheek, the second over the anterior cheek. The pelvic curve, if the forceps possesses one, is directed anteriorly. The head is then elevated *very slowly* and symmetrically from the pelvis and through the uterine wound. (See Chapter IX.)

II. THE LONGITUDINAL OPERATION

In performing the lower segment operation a longitudinal uterine incision has up to now been so frequently the only one employed, especially in the leading clinics of Europe and America, that an account of this method will not here be out of place. I have used it in only a few cases, and then mainly for 'experimental' reasons.

TECHNIQUE*

A slight degree of Trendelenburg position is of assistance in the preliminary stages. The use of a lateral abdominal self-retaining retractor is sometimes preferable to the Doyen, which tends to diminish the available retropubic space. The uterovesical peritoneum is, as before, divided transversely, but at a slightly higher level.

* This is illustrated by drawings from an actual operation which was filmed.

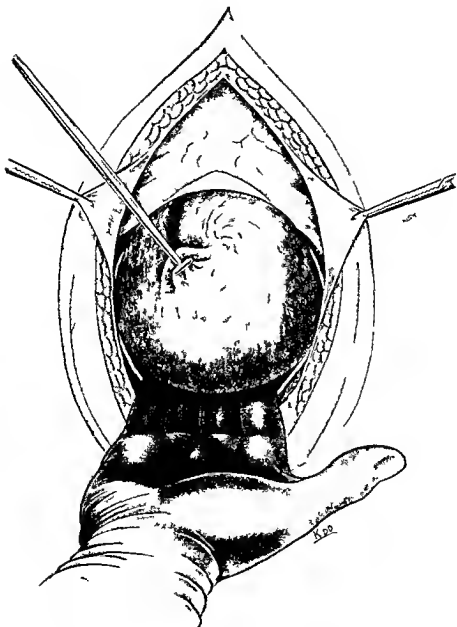


Fig 48—Deleer of the head. Scalp tract on a s ed by insert on of the fingers bet een the head and the edge f the lo er flap

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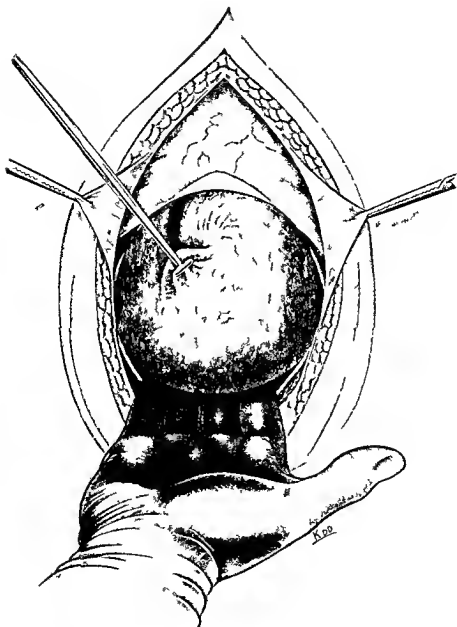


Fig 48—Delivery of the lead. Scalp tract on a sisted by insertion of the fingers between the lead and the edge of the lower flap

Formation of an Upper Flap of Peritoneum.—To the centre of the edge of the upper flap a Spencer Wells forceps is attached. This is held up in the left hand, and *with light scissor-dissection the loose connective tissue binding it to the front of the lower segment is divided.* The peritoneum is thus raised at least as high as the level of the greyish white band where it begins to gain a firm attachment to the uterus.

Downward Displacement of the Bladder.—The bladder should *in all cases* be wiped completely down until it comes to lie on the front of the vagina. Only by taking full advantage of the retro-vesical area can the vertical incision be confined to the lower segment and cervix. Even then this will not be completely possible if the patient is not in labour. The bladder is again maintained in this position with a swab over which the Doyen is placed, or, if this is not used, by the help of the assistant, who protects it with two fingers of the left hand or a narrower form of retractor passed over the pubes.

Vertical Incision of the Lower Segment.—The more truly this is median, the less will be the bleeding encountered. A short incision is made with light strokes of the scalpel in the upper part of the lower segment. The succeeding steps can now be varied according to the conditions met. It is a great advantage when these can be carried out in a field that remains entirely unobscured by blood and liquor.

1. If bleeding from the muscle is free, the small incision is quickly deepened, the uterine cavity opened, and, if the vertex is presenting, the scalp is secured with the forceps. Holding the latter upwards in the left hand, the lower part of the segment and the cervix are once again elevated into the abdominal wound and rendered more accessible to further division with the scissors. The incision may now be enlarged downwards into the internal os (or even the vagina if labour is advanced—Stoeckel). Manual (or occasionally forceps) delivery is then effected.

2. If in similar circumstances the breech is presenting, I prefer, through the small original incision, to secure and deliver one of the feet (if these are presenting), or to pass a finger into the anterior groin. In this manner the lower segment can be placed on the stretch, drawn up, compressed from within, and the incision extended in good visibility and without loss of blood.

3. Not rarely the initial incision may be perfectly bloodless. The membranes are carefully exposed but not opened. The division

of the muscle is now continued downwards with the scissors. Not until this is completed are the bulging membranes ruptured and the presenting part (breech or vertex) delivered.

4 Through the initial incision two fingers are inserted and the incision is extended with the scissors in the same way as one commonly opens the parietal peritoneum.

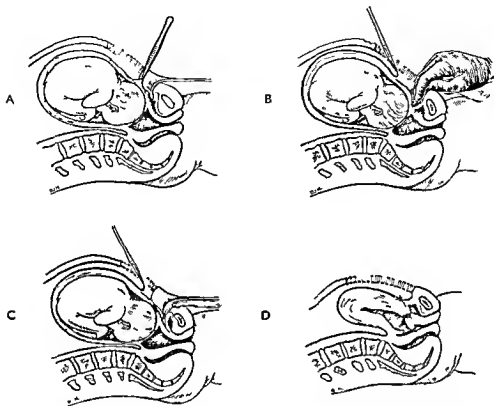


Fig. 49—A Opening uterovesical peritoneum. B Drawing down the bladder. C Doyen replaced over swab on top of bladder. D Uterine incision closed and visceral peritoneum restored.

When the breech is presenting, the injection of pituitrin (if it is to be used) should be given at the moment the incision of the uterus is begun. The trunk is extracted very slowly, the arms being delivered in turn over the edges of the incision. Extreme care is necessary with the head in order to prevent sudden extension of the incision.

The lower angle of the incision is immediately secured and the first suture passed.

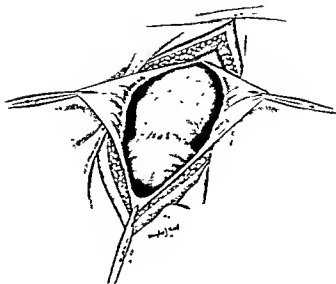


Fig. 50—Abdomen opened. Patient not in labour. Breech presentation. Empty bladder found drawn up high above symphysis and spread over lower segment. (*This and the succeeding six illustrations have been drawn from a film.*)

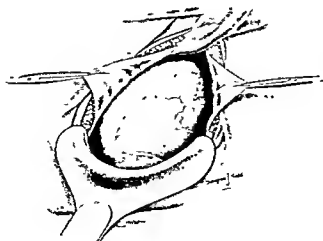


Fig. 51.—Bladder drawn down by edge of Doyen.

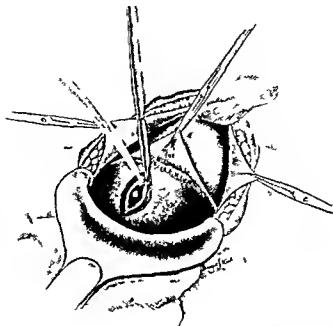


Fig. 52—Bladder has been wiped down and protected by swab and Doyen, and upper peritoneal flap raised by light dissection. Initial incision being made.

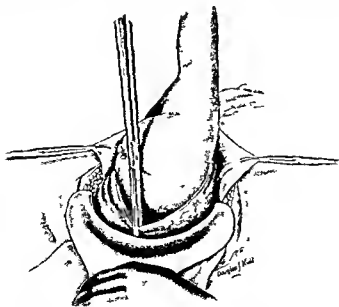


Fig. 53—Foot held in left hand while incision is extended right down into true cervix with the scissors.

III. THE CONDUCT OF THE THIRD STAGE

The cord is clamped and divided and the infant transferred to the nurse. The uterus is never lifted out of the abdominal cavity. No rough or heroic handling is permitted.

Within two to three minutes the placenta will generally appear in the incision. When this fails to occur the fundus is grasped

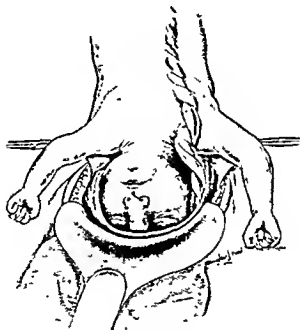


Fig. 54.—Head about to be born.

through the abdominal wall and the placenta gently expressed. It is lifted out of the lower segment by the cord, and the membranes are twisted off the uterine wall. The hand is at no time passed into the uterus. In short, a natural third stage is always encouraged.

IV. THE CLOSURE OF THE UTERINE WOUND AND THE RESTORATION OF THE UTEROVESICAL PERITONEUM

The inner suture has already been introduced and knotted in the distal angle of the wound. It is now continued and includes the

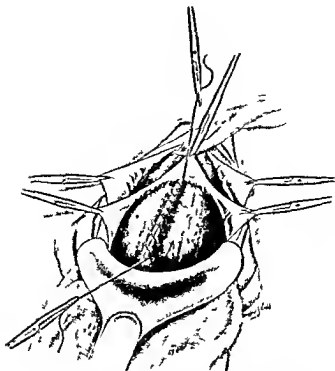


Fig 55 — Uterine wound closed and suture line displayed by traction on first and last sutures

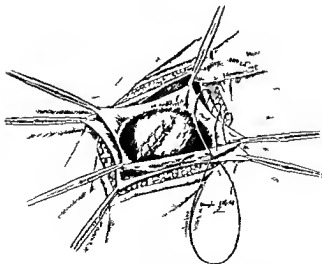


Fig 56 — Appearance when uterine incision is allowed to drop back into the pelvis. Shows closure of visceral peritoneum with continuous suture which inverts the edges towards the uterus

decidua with the deeper portion of the muscular wall. The loops are regularly and closely spaced. These, if drawn sufficiently taut, secure complete hæmostasis and a perfectly watertight apposition. Not more than one in twenty cases will require an additional ligature to control some bleeding point. The angles are carefully included in the first and last passages of the needle. An outer suture then unites the superficial layer of muscle and its overlying fascial tissue.

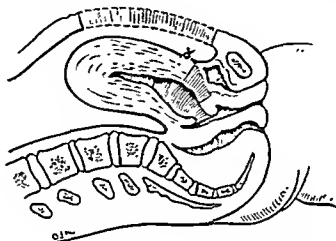


Fig. 57.—Showing final position of wound after closure and restitution of uterovesical peritoneum and bladder.

If the vertical incision has been used, I begin the suture in the lower angle. Though it is not essential, I prefer to use closely spaced interrupted sutures to unite the deeper layer. This is then buried with a continuous suture which includes the superficial muscle and fascia.

Suture of the Uterovesical Peritoneum.—There is always a redundancy of peritoneum. The centre of the vesical flap is sought, and raised into the wound with a pair of Spencer Wells forceps. Great care is taken to remove any clot of blood that may have formed in the retrovesical space. The suture begins in the far angle and only the finest catgut is used. The suture is of the Lembert type, is inserted some distance from the margin of each flap, and inverts the raw edges towards the uterus (*see Fig. 56*). After each passage of the needle the catgut is pulled taut, and when completed the suture line is rarely more than two inches in length. In this way all the slack peritoneum is taken up, the bladder is somewhat elevated, and

an incision, even if it may not primarily have been retrovesical, comes to lie so at the end of the operation. The protective gauze is removed and any blood or liquor which may have accumulated in the iliac fossæ is mopped away.

V. THE CLOSURE OF THE ABDOMINAL INCISION

The parietal peritoneum is closed with a running suture of fine catgut which everts the cut edges. For the rectus fascia the suture is also continuous, reinforced here and there with a few interrupted sutures. Two or three silkworm gut sutures may be used to unite the skin and fatty layer. I usually omit these. In some cases it may be advisable to undertake some form of 'repair' of the abdominal wall. Unless an actual hernia is known to be present this is never done in any but the clean type of patient.

The skin is closed with Michel clips.

VI. REPEATED CÆSAREAN SECTION

A previous operation does not necessarily render another more difficult. In my own cases I have met adhesions only thrice, and these consisted simply of slender bands between the omentum and the abdominal wall. The only constant sign of a previous intervention is a thin whitish transverse line in the presegmental or uterovesical peritoneum. In some there is also a little silvery streaking of this membrane in the floor of the uterovesical pouch. Generally the peritoneum can be readily raised from the uterus and with few exceptions displacement of the bladder will present no special difficulties.

So far I have been unable to identify with certainty the old scar in the uterine wall. In three instances in which the vertical incision was employed where the previous one had been transverse, I have excised a strip of tissue from the whole length of the lower segment. On microscopical investigation it was difficult to fix upon any area that could with accuracy be labelled as the site of the previous incision.

CONCLUSIONS

If the author's method is distinguished by any special feature, it may be said to lie in an attempt to place the incision as low as possible in the uterus. In almost all those patients who have been in labour

for any considerable time, it is an easy matter, owing to the development and expansion of the lower segment and cervix, to incise the uterus transversely at a level which is retrovesical. In all other cases everything depends on making the small initial incision sufficiently low. Owing to its depth, its extension may, at first sight, seem a formidable or dangerous business. But if, immediately the uterine cavity has been entered, advantage is taken of one or other 'traction method', the area to be further incised is raised into the abdominal wound, and the lateral extensions can be made with boldness and confidence. It should be remembered that the method of employing the half-breech or 'finger-in-the-groin' is just as applicable when the transverse incision is chosen. Similarly the scalp forceps fulfils its object equally well when the longitudinal method of operating is selected. It should not, however, be applied to the scalp of the premature infant, as this is very prone to tear.

More recently I have come to believe that for most of those patients who are not in labour the initial incision is best spread with the fingers as recommended by Geppert and others.

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CHAPTER V

THE INFECTED PATIENT

PROTECTION AGAINST INFECTION

INFECTION is the greatest fear in Cæsarean section. Peritonitis is its crowning disaster. Among 102 deaths that could fairly be charged to the cervical operation von Ammon found that 18 were due to the former and 51 to the latter cause. It is not surprising, therefore, to find that of the many special measures and suggested modifications in the technique, the great majority are directed particularly against these two evils.

I PRELIMINARY PROCEDURES

Pre-operative Vaginal Antiseptics.—Danforth and Greer use mercurochrome for this purpose, and Evers agrees with the soundness of such a course. My own feeling that vaginal interference is likely to be more harmful than good is difficult to maintain in the face of the excellent results published by Arnot. 253 sections performed in the University of California Hospital between 1925 and 1936 passed off without mortality, routine vaginal cleansing was carried out in all suspect or infected patients. Nevertheless the great majority eschew all such pre-operative measures.

Anæsthesia.—This may possibly exert an indirect influence on the development or spread of infection in the peritoneal cavity (see p. 60).

Position of the Patient.—The Trendelenburg position may favour the drainage of any vaginal secretions or discharges back into the uterus. Munro Kerr, Evers, and Bailey in this country, and most operators abroad, have stressed the importance of the horizontal position, any spill is thus confined to the retropubic space, whence it can readily be mopped away. Other arguments have been advanced against the Trendelenburg position. Tearing of the lower segment, or even colporrhæxis, is regarded as a possibility if this position is adopted when labour is advanced and the lower segment greatly thinned. There are also grounds for believing that air embolism is more likely to occur.

Gauze Rolls, Compresses, Sheets of Rubber Dam, Etc.—Most surgeons use one or other of these to wall off the zone of operation from the rest of the peritoneal cavity. Disposed between the uterus and abdominal wall they prevent gross contamination of the bowel. *Dry gauze or packs should not be used*; they adhere to and roughen the peritoneal surface and must favour the formation of adhesions. J. Léon has suggested a method in which after packing off the uterus

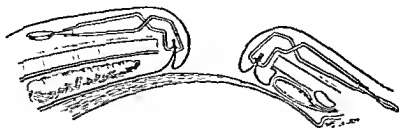


Fig. 58 —Léon's method of excluding the edges of the abdominal incision and the peritoneal cavity from the zone of operation.



Fig. 59 —Special clamp used by Léon.



Fig. 60 —Torpin's combined bladder retractor and aspirator.

he excludes the peritoneal cavity by clamping "impermeable compresses" to the upper and lower edges of the incision in the utero-vesical peritoneum. He has treated in this way 12 patients, of whom 10 were definitely infected. There was one death from pneumonia.

Aspiration of the Zone of Operation.—Audébert, D'Acerno, DeLee, Torpin, and others recommend an electrically driven aspirator; with it the assistant keeps the field completely free of all blood and liquor.

Aspiration of the Liquor Amnii.—Sztehlo, after placing the patient in a steep Trendelenburg position, divides the utero-vesical peritoneum and inserts a catheter through his small initial incision in the lower segment. The fluid contents of the uterus are removed by aspiration. In Geppert's clinic a simple trocar and cannula is used (Häuser). But Wolfring maintains that there are no advantages in aspiration, it is impossible to remove the liquor completely, it leads to some degree of fetal asphyxia, and, finally, better results have not been obtained by such a course.

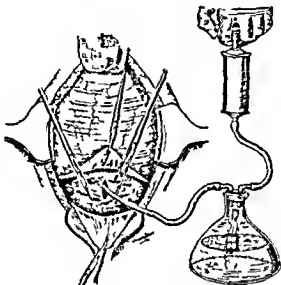


Fig. 61.—Aspiration of the uterus (drawn from Szezhlo)

II EXCLUSION AND PERITONIZATION OF THE UTERINE INCISION

a **Operations which Aim at Eliminating both Primary and Secondary Peritoneal Infection.**—Merger meets the infected case with a technique for which he claims the following advantages: (1) The possibility of safe abdominal delivery in any infected woman irrespective of the degree of dilatation of the cervix, (2) Protection of the patient against both primary and secondary peritoneal infection through the uterine incision, (3) Only a single intervention is necessary (cf. operation of Portès).

Briefly the operation is as follows: Median subumbilical incision stopping short of the linea alba. Each rectus sheath is opened close to the midline, and both muscles are retracted laterally from their beds.

Gauze Rolls, Compresses, Sheets of Rubber Dam, Etc.—Most surgeons use one or other of these to wall off the zone of operation from the rest of the peritoneal cavity. Disposed between the uterus and abdominal wall they prevent gross contamination of the bowel. Dry gauze or packs should not be used; they adhere to and roughen the peritoneal surface and must favour the formation of adhesions. J. Léon has suggested a method in which after packing off the uterus

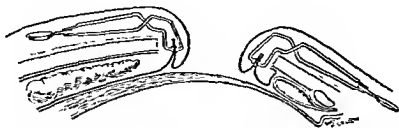


Fig. 58 —Léon's method of excluding the edges of the abdominal incision and the peritoneal cavity from the zone of operation.



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he excludes the peritoneal cavity by clamping "impermeable compresses" to the upper and lower edges of the incision in the utero-vesical peritoneum. He has treated in this way 12 patients, of whom 10 were definitely infected. There was one death from pneumonia.

Aspiration of the Zone of Operation.—Audébert, D'Acerno, DeLee, Torpin, and others recommend an electrically driven aspirator; with it the assistant keeps the field completely free of all blood and liquor.

This surgeon successfully treated 8 cases in this way, all of which were gravely infected, with temperatures ranging even as high as 39°C . One patient has since been delivered without difficulty by classical section performed at the beginning of labour.

Michon opens the abdomen in the usual way, transversely incises the uterovesical peritoneum and raises an upper visceral flap which he then splits vertically. The edges of the flaps so formed are clamped by a series of artery forceps to the borders of the parietal

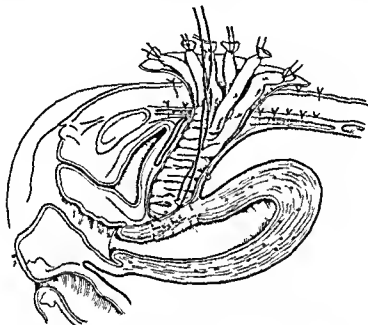


Fig. 64—Merger III. Sagittal section showing final arrangement and disposition of Mikulicz drain.

peritoneum. The vesical flap is likewise clamped to the parietal peritoneum in the lower angle of the wound. The entrance of blood and liquor into the general peritoneal cavity is thus prevented while the uterus is being evacuated through a longitudinal incision. After closing the uterine wound, the artery forceps are removed and the uterovesical cul de sac is restored with a purse string suture. In impure cases the forceps are left on for forty-eight hours and the wound is packed with gauze. Michon at the time of writing had practised this operation for five years without maternal mortality.

Recently Ramos, Peralta and Bella (1936) have successfully treated 6 infected cases in a somewhat similar manner, their procedure, however, like the one recommended by Wodon is distinctly

so that a triangular area remains which is formed of the linea alba, fascia transversalis, and parietal peritoneum. A flap consisting of these layers is reflected downwards. A similar triangular flap is fashioned from the mobile peritoneum on the front of the lower segment; at its base is the bladder. The margins of the peritoneum which bound the denuded area of the uterus are united by suture to the edges of the parietal peritoneum. The bladder is then wiped

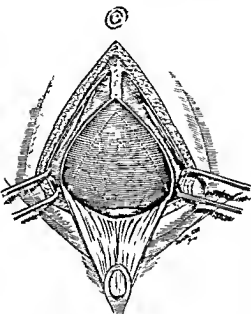


Fig. 62 — Merger I. Rectus muscles retracted, triangular flap of parietal peritoneum, linea alba, and transversalis fascia turned down over pubes. Corresponding flap of visceral peritoneum marked out with stippled line. (This and Figs. 63 and 64 are redrawn from Merger.)

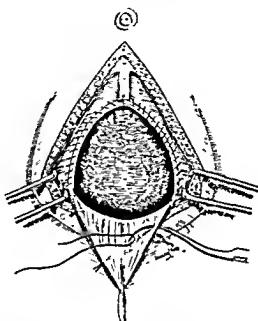


Fig. 63 — Merger II. Visceral flap now turned down and in process of being sutured to parietal flap. The edges of the parietal peritoneum have been sutured to the edges of the uterine peritoneum.

downwards, the two reflected flaps are applied to each other, and their edges are joined with a few interrupted sutures; the only potential channel of communication between the field of operation and the general peritoneal cavity is thus obliterated. The uterus is incised longitudinally and the infant delivered. The wound is closed in two layers, the first row of interrupted catguts being buried with a continuous suture. A Mikulicz drain is laid directly on the wound in the lower segment. The abdominal incision is closed in three layers—muscular, fascial, and cutaneous.

the peritoneal suture line a swab is laid. The bladder is now pushed downwards and the uterus opened transversely. After closure of the uterine wound the bladder flap of peritoneum is drawn up and its edge sutured to the lower segment close to the visceroparietal suture line. The rectus muscles and fascia are separately closed with interrupted sutures, and the wound is drained from its lower angle. When he feels it to be necessary, the retrovesical space is drained through the anterior vaginal fornix.

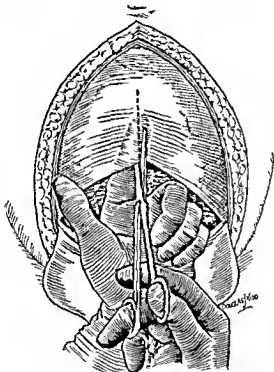


Fig. 66 —Micheu II. Median vertical division of upper visceral flap

Gianella uses the Pfannenstiel incision, but otherwise his visceroparietal suture is almost exactly the same as Wodon's.

A method, which has simplicity to commend it, has recently been described by W. R. Cooke in the following way. A line of continuous suture, excluding the general peritoneal cavity from the field of operation, is started at each internal inguinal ring, the round ligament is sutured to the parietal peritoneum to a level varying with the lie of the ligaments, from this level the line of suture is carried obliquely upward and inward across the anterior leaf of the broad ligament

reminiscent of the early operation of Frank. They place the uterine incision transversely, but, like Michon, enlarge it with the fingers.

Wodon believes he can circumvent the difficulties and dangers of the true extraperitoneal operation and yet retain its advantages by proceeding in a simpler way, thus: Median abdominal incision of skin and rectus fascia. The bellies of the rectus muscles are retracted from the midline to expose a wide triangular area of transversalis



Fig. 65 —Michon I. The visceral peritoneum has been divided transversely and the upper flap is being raised from the uterus by blunt dissection. (This and Figs. 66 and 67 are redrawn from Michon)

fascia and parietal peritoneum. These layers are divided transversely just above the bladder, which is then retracted deeply behind the symphysis pubis. The visceral peritoneum is now incised almost from one round ligament to the other just above its uterovesical reflection. An upper flap is sufficiently raised to expose the whole of the anterior wall of the lower segment. The free border of this peritoneal leaf is united with a continuous suture to the lower edge of the parietal peritoneum. Purse-string sutures accurately close the lateral angles and thus cut off the general peritoneal cavity. Over

the extraction of the infant To avoid this Gianella employs a series of short continuous sutures On account of the delicate texture of the visceral peritoneum they must be inserted with great gentleness The strength of the visceral flaps is also increased if care is taken to raise with them all the subperitoneal fascia

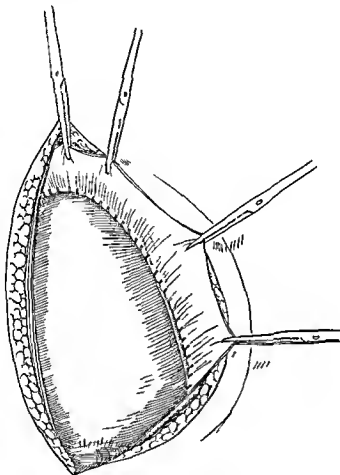


Fig 68—Cooke's operation

If the circumstances of the case warrant the employment of any of these procedures, then, I believe, they also call for drainage of the uterine incision The visceroparietal suture should not be removed, the rectus fascia and skin should be separately united, and the site of the uterine incision directly drained through the lower angle of the wound

until the uterus is reached; thence to a point about 2 cm. above the top of the laparotomy incision, fixing the anterior wall of the uterus to the anterior parietal peritoneum. A Gothic arch is thus formed, each side and the base measuring about 17 cm., a total periphery of about 50 cm., a gauze pack is placed snugly against the lines of excluding suture, and a low type of section performed in the usual way.

There were no deaths among 26 infected patients in whom the operation was employed (*Fig. 68*).

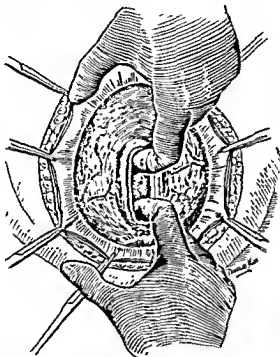


Fig. 67.—Wichon III. The edges of the parietal clamped to the edges of the visceral peritoneum. Vertical 'blunt incision' of the uterus.

There are other operations of this nature, but they only differ from the above in minor and inconsequential details.

CONCLUSIONS.—Munro Kerr, in discussing the problems of the infected patient, has suggested that the above or similar methods might well be given a trial. They do not add greatly to the duration of the operation. Suture union of the flaps is probably preferable to temporary clamping. Care must be taken, however, not to draw the suture too tightly, otherwise the available area of lower segment will be reduced and the integrity of the union will be endangered during

Audébert, seeing certain disadvantages in incising the uterovesical peritoneum transversely if the uterus is to be opened longitudinally, makes a vertical incision in the visceral peritoneum, raises two lateral leaves, and then overlaps these in closure. This way of incising the peritoneum has recently been advocated by Fulconis. If infection is suspected, the latter surgeon does not close the peritoneum completely, but places a gauze drain between it and the front of the lower segment.

Martius also divides the lower segment peritoneum in the mid-line. It is closed transversely and the bladder drawn up in front of the uterine incision (*Figs 71, 72*).

Sztehlo closes the uterine wound and restores the uterovesical peritoneum in the usual way. The parietal peritoneum in the lower part of the abdominal wound is then sewn with a purse-string suture to the front of the cervical peritoneum. The uterovesical pouch is thus obliterated and the uterine incision is doubly protected. In 30 suspect or infected cases this method was completely successful.

Of the methods outlined above my own experience is meagre. On a few occasions I have buried my transverse uterine incision according to the double flap method of Beck and DeLee. On others, when I have felt a little extra protection necessary, the uterovesical suture has been duplicated and the bladder raised to a still higher level in the way that Martius has illustrated.

III METHODS OF DRAINING THE UTERINE CAVITY

In cases in which uterine infection is already firmly established, or, because of purulent vaginal or vulval conditions, will almost certainly arise, open drainage of the organ may sometimes be advisable. For its use on less strict indications than these I can find little justification, though a few, among them an authority like Daels, seem to resort to it quite frequently.

a Drainage through the Abdominal Incision: 'Utero-abdominal' Fistula.—Schlheim II is the prototype of modern methods of draining the uterine cavity. Sufficient has been said of the technique. Khmek (1933) collected from the world literature 15 instances in which this operation had been used. 2 patients died of peritonitis, in 3 who again became pregnant, 2 carried to term, one being delivered normally, the other by Cæsarean section.

b. Prevention of Secondary Peritoneal Infection (double-flap closure, elevation of bladder and vesical flap, etc.).—Beck, DeLee, and many others have practised the following operation: The loose visceral peritoneum is divided transversely halfway between its reflection on to the bladder and the line where it gains a firm attachment to the uterus. The bladder and the lower flap are displaced downwards. The upper flap is raised as far as the greyish line or seam which delimits the lower segment from the body of the uterus. The uterine incision is longitudinal. When the latter has been closed, its upper

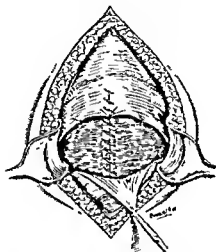


Fig. 69.—DeLee I. The upper flap is brought down over the upper part of the uterine incision and fastened to the uterus by a few sutures. (Redrawn from DeLee.)

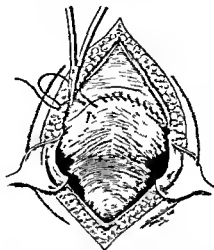


Fig. 70.—DeLee II. The upper flap is now overlapped by the vesical flap, which is sutured to the front of the uterus. (Redrawn from DeLee.)

part is covered by drawing down the uterine flap and anchoring it to the fascia on the front of the lower segment with a few interrupted sutures. The vesical flap carrying the bladder is then raised and sutured to the front of the upper one. "Of late years in clean cases we have not overlapped the peritoneum, as we have found a shortage of this membrane in subsequent sections" (DeLee).

Kassenbohm and Schreiber perform an exaggerated double-flap operation. The whole of the segmental peritoneum and bladder are so deeply undermined in the early stages that the lower flap can finally be raised and sutured high up to the front of the body of the uterus. The uterine incision is cervical or cervico-corporal.

In a case described by Serini the patient was delivered first according to the method of Fromme Veit a second time two years later by the Sellheim procedure and finally by classical Cesarean section

An unreported operation at which I assisted a senior colleague (A. A. Gemmell) is worth recording here

The patient was a primigravida. Intra uterine death of the fœtus had occurred some weeks previously. On attempting to induce labour instrumentally a central placenta previa was discovered which resisted all attempts to separate it from the uterine wall. At Cesarean section the uterine wall was greatly thinned and quite anemic. After the extraction of the child the wall remained quite flaccid. Again it was impossible to find any plane of cleavage between the placenta and the uterine wall. As an alternative to hysterectomy a utero abdominal fistula was created through which pieces of placenta were gradually extruded during the puerperium.

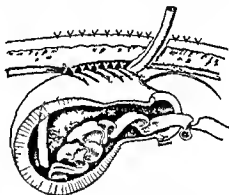


Fig. 73.—Dral ago by Holzbacl s
t etlod (he drawn fro n Holzbach)

This surgeon was well rewarded for his enterprise, he has since delivered his patient of a living infant by Cesarean section. Though histological evidence was lacking the condition could only have been one of placenta previa accreta.

In the above instance Sellheim's operation seemed to find its ideal application—as the only alternative to hysterectomy in a woman who was strongly desirous of conceiving again and bearing a living child.

Holzbach has described a method of draining the uterus which was suggested to him by Witzel's gastrostomy operation. He claims it offers most of the advantages and none of the disadvantages of the Sellheim operation. The tube leaves the uterine cavity through a small opening at the upper end of the first uterine suture line. It is then buried by a second row of sutures and led out through the abdominal incision. In one case the tube was removed on the seventh day and his patient left hospital with the wound firmly healed on the seventeenth day.

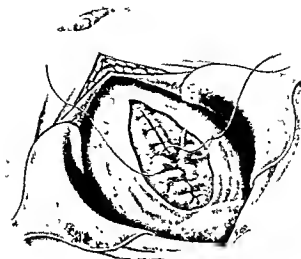


Fig 71 —The peritoneum is split longitudinally. Note the Z-suture employed by Martius in closing the uterine incision.

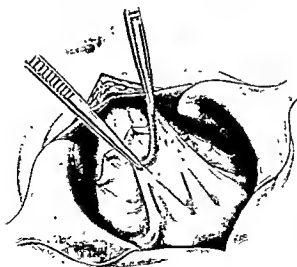


Fig 72.—Showing how the uterine incision is peritonized and rendered retro-vesical. (This and *Fig. 71* are redrawn from Martius)

In a case described by Serini the patient was delivered first according to the method of Fromme-Vert, a second time two years later by the Sellheim procedure, and finally by classical Cæsarean section

An unreported operation at which I assisted a senior colleague (A A Gemmell) is worth recording here

The patient was a primigravida. Intra uterine death of the foetus had occurred some weeks previously. On attempting to induce labour instrumentally a central placenta prævia was discovered which resisted all attempts to separate it from the uterine wall. At Cæsarean section the uterine wall was greatly thinned and quite anæmic. After the extraction of the child the wall remained quite flaccid. Again it was impossible to find any plane of cleavage between the placenta and the uterine wall. As an alternative to hysterectomy a utero abdominal fistula was created through which pieces of placenta were gradually extruded during the puerperium.

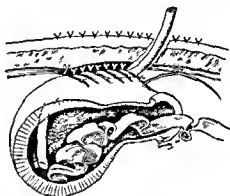


FIG. 73.—Drainage by Holzbach's method (Redrawn from Holzbach)

This surgeon was well rewarded for his enterprise, he has since delivered his patient of a living infant by Cæsarean section. Though histological evidence was lacking the condition could only have been one of placenta prævia accreta.

In the above instance Sellheim's operation seemed to find its ideal application—as the only alternative to hysterectomy in a woman who was strongly desirous of conceiving again and bearing a living child.

Holzbach has described a method of draining the uterus which was suggested to him by Witzel's gastrostomy operation. He claims it offers most of the advantages and none of the disadvantages of the Sellheim operation. The tube leaves the uterine cavity through a small opening at the upper end of the first uterine suture line. It is then buried by a second row of sutures and led out through the abdominal incision. In one case the tube was removed on the seventh day, and his patient left hospital with the wound firmly healed on the seventeenth day.

Daels rightly considers his own is superior to the above method in that the cervix is held open, most of the lochial discharge passes through this channel, and irrigation of the organ can easily be carried out. In his operation the peritoneal cavity is protected with large gauze swabs. The uterovesical peritoneum is divided transversely and the uterus opened longitudinally. A T-shaped tube is used, a ligature being tied round the lower half of the cross-piece, which projects into the vagina. After closure of the uterine incision the parietal and visceral peritoneum are united so as to obliterate the uterovesical pouch and reinforce the wound in the uterus. The slightest rise of temperature during the puerperium is an indication for irrigating with a solution of 1 per cent chloramine-glycerin. The tube is finally removed by traction on the vaginal portion after cutting

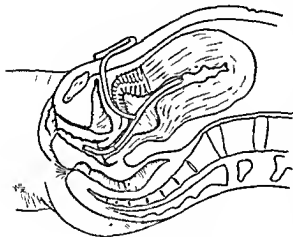


Fig. 74—Daels' method of drainage.
(Refracted from Daels)

off the abdominal extension flush with the skin. Daels has employed this procedure in 50 cases. The only maternal death was due to eclampsia. All the operations were performed under local anaesthesia.

b. Cervical Drainage.—Immediately after delivery the cervix quickly refills with blood, the walls of the canal fall lightly into contact, and the structure assumes at

once a weak sphincteric control over the lochial discharge. For this reason a few believe it wise, when dealing with the potentially infected case, to maintain the canal wide open for the first few days of the puerperium. Munro Kerr carefully disinfects the lower segment and places a large drainage tube through the cervix with the end projecting well down into the vagina. Gauze soaked in glycerin and iodine (3 per cent) is packed round the tube in the lower segment. Cervical drainage is also employed by Green-Armytage, who removes the tube in forty-eight hours.

Drainage in this manner receives little mention in the Continental or American literature.

IV DRAINAGE OF THE PERITONEAL CAVITY

Some surgeons carefully close the uterovesical peritoneum and place a drainage tube down to the uterovesical pouch. The difficulty in appraising the value of this is due to a variety of reasons —

1 Many writers neglect to say whether they drain or not

2 It is found that the mortality in the group that has been drained is almost invariably higher than in the group that has not been drained. This is not an argument against drainage—it simply demonstrates the higher mortality among the suspect and infected cases

3 There are not available any two series of operations performed by the same surgeon on cases of a similar kind in one of which drainage was used and in the other not used. Nevertheless Geller, who has investigated a considerable amount of material, concludes that drainage is not an advantage

4 Neither closure with drainage nor closure without drainage will prevent the onset of fatal peritonitis. While one surgeon states that his patient died despite drainage, another regrets a death which 'might have been avoided had he drained'

I therefore set out, though not without hesitation, my own beliefs and practice. They are the outcome of the experience gained from my own cases, and the result of observation of the work of other surgeons whose views are sometimes diametrically opposed to my own.

I never drain the peritoneal cavity. At the end of the operation the uterine incision lies behind the bladder, the closure is watertight, and the level of the suture line in the uterovesical peritoneum lies usually some two inches higher. (These are conditions which are not in any way comparable with those that may exist at the end of certain difficult gynaecological interventions where complete peritonization may be impossible and raw, oozing surfaces must be left. Drainage in such cases, if not imperative, is perfectly reasonable.) Any liquor, blood, or blood clot that could be seen has been mopped away from the lateral vesical fossæ, the front of the broad ligaments, and the iliac fossæ. If the uterine contents have been infective, then only microscopical contamination of the peritoneum must persist. With this I believe the peritoneum is perfectly capable of dealing. How else can we explain the clinical facts? In some of my own patients there was the clearest evidence of uterine infection before the operation, in many signs of puerperal endometritis quickly appeared, while in others both wound and uterine sepsis occurred

in the puerperium. Yet with one exception (and this only secondary to wound infection) the peritoneum entirely escaped.

In short, I believe the danger of the "primary spill" has been greatly exaggerated, and that in nearly all cases where peritonitis has been attributed to this there has also been leakage through the uterine incision. In such cases the uterine wound and the uterovesical suture will commonly be found at the same level (*Fig. 75*), or, if the vertical



FIG. 75.—Uterus, vagina, and bladder from a patient dying on the fifth day of acute endometritis and peritonitis. Section was for central placenta prævia at the thirty-fifth week, after the vaginal application of scalp forceps had failed to control bleeding. The uterine incision is too high and lacks protection of the bladder.

incision has been used, the chief path of infection will be found in its upper part. Merikallio has seen two patients in whom fatal peritonitis was caused by leakage through the "corporeal part" of the segmental incision. In other words the protection has been little better than that offered by the classical operation. In the latter operation it is extremely rare to find that death is due purely to uterine infection—the uterine wound is invariably infected and peritonitis present. On the other hand, severe and even fatal puerperal endometritis may exist and yet peritonitis not necessarily arise if a *low* retrovesical operation has been performed.

The cases reported by Rossenbeck, and Trillat and Dargent are of exceptional interest:—

Rossenbeck's Case.—Cæsarean section performed for post-maturity and disproportion (infant weighed 4340 g.) at least twelve hours after the membranes had ruptured. Death occurred on the thirteenth day of puerperium. Autopsy showed acute puerperal endometritis and myometritis, thrombosis of the right ovarian veins, small emboli in the finer

branches of the pulmonary arteries, and enlarged spleen from which hæmolytic staphylococci were cultured. *The transverse lower segment incision (Doerfler) was found completely healed and free from all infection.*

Trillat and Dargent's Case.—Cæsarean section for contracted pelvis after fifty-eight hours in labour. Michon's exclusion technique employed. On the eleventh day of the puerperium there was a discharge of pus per vaginam. Thickening was felt in the right broad

ligament. Rigors began to occur and streptococci were found in the blood. A collection of pus was released from the left thigh on the forty-fourth day. After a long pyrexial course death followed seventy-three days after the operation. Post-mortem demonstrated that perfect healing had occurred through the whole extent of the lower segment scar, though there was pus in the broad ligaments.

Recently I attended a post-mortem on an elderly primipara, death having occurred on the eighth day —

Fever was present and the liquor putrescent when Cæsarean section was undertaken. The peritoneal cavity was not drained. The puerperium was febrile. When the abdomen was reopened there were no signs of peritonitis and the uterovesical peritoneum was intact. There was evidence of slight infection of the uterine wound (transverse), the retrovesical tissue, and the subperitoneal tissue, though without any pus formation. The uterine incision lay well below the floor of the uterovesical pouch and was not more than 1 in. above the external os. Cause of death: acute puerperal endometritis.

Drainage of the peritoneal cavity may even be harmful. Clear or blood-stained fluid is discharged through the tube, but, in the cases I have seen, it has not become purulent. Possibly the secretion is of a highly protective nature, or simply a response of the peritoneum to irritation. The tube may interfere with sound and rapid healing of the presegmental peritoneum, or even of the uterine incision. Formation of adhesions is a common sequela, and the risk of ileus is, I think, always greater in those who are drained.

Drainage of the uterine wound through the peritoneal cavity is another matter, and with it I have no special quarrel, though I never employ it myself.

V. DRAINAGE OF THE UTERINE INCISION

Abdominal Drainage.—If this is contemplated, the uterovesical plica should be loosely sutured, or, better still, left open in its middle part, and a tube, gauze drain, or piece of rubber dam placed directly down to the uterine wall. Evers uses a split tissue drain: one portion goes to the uterine wound, the other is laid in the uterovesical pouch.

Vaginal Drainage.—Opitz was the first to employ this route. After pushing the bladder as low as possible the anterior fornix is opened, the gauze or tube drain is passed into the vagina, and the uterovesical peritoneum restored.

Hauch (1927) collected more than 10 instances of retrovesical abscess following the lower segment operation, and described a case

of his own. Cure followed anterior vaginal colpotomy. He has since drained the retrovesical spaces on several occasions, using a modified Opitz technique.

The uterine wound is closed, and a mesh of gauze is packed behind the bladder so deeply that an assistant may feel it distinctly per vaginam. The uterovesical suture is then inserted and the abdominal wound closed. With the patient in the lithotomy position anterior colpotomy is performed, and the gauze withdrawn and replaced by a tube. One suture fixes it to the margin of the vaginal incision. The tube must project beyond the vulva to avoid retrograde infection from the lochia.

In cases where the bladder has been displaced much can be done

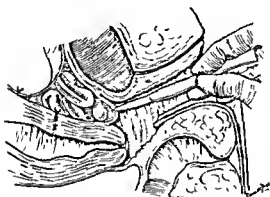


Fig. 76 —Hauch's method of draining the uterine incision and cervicovesical space. The anterior vaginal fornix is being incised.

to obliterate any dead space by taking up all the 'slack' when reuniting uterine and vesical flaps of peritoneum. The filling of the bladder, the pressure of the pelvic colon and rectum, and the weight of the uterus itself must soon render this space a purely potential one. A retrovesical phlegmon is rare and has arisen only once in the author's series of cases:

The presence of fever and vesical irritability was at first put down to cystitis. Within a few days slight oedema of the right labium majus appeared, and vaginal examination revealed a mass lying in front of the uterus and extending into the right broad ligament. By the fourteenth day it was palpable above the inner part of Poupart's ligament, where it was drained extraperitoneally through a small incision.

SUPPURATION IN THE ABDOMINAL WOUND

The tissues divided during Cæsarean section offer varying degrees of resistance to bacterial invasion. Peritonitis is comparatively uncommon. Uterine sepsis is relatively frequent. The cellular and fatty tissue of the abdominal wall is by far and away the most vulnerable to infection.

Wound infection may be expected to occur in *at least* 1 out of every 4 suspect or infective cases. In the majority of instances

the infection is of a trivial nature. It involves the extreme lower angle ten times as frequently as it affects any other part. Between the fourth and seventh days some redness appears in the skin usually round the lowermost inch of the wound, two or three clips are removed, a probe is inserted, and a small amount of pus is released. The wound edges rarely separate for more than an inch, and the abscess cavity hardly ever exceeds this in depth. The most serious effect of this is merely to increase the stay of the patient in hospital by a few days. In many cases the infection is not even so extensive as this, and may be limited to a small discharge of pus or only serum and the formation of a tiny sinus in the lower angle of the wound. On the other hand, in a very few cases the whole length of the wound may suppurate, with extensive separation of its edges. When only the superficial layers are involved life is little endangered though convalescence is greatly delayed. But if the wound should part throughout most of its depth, then there is grave danger of the peritoneal cavity becoming infected. Brouha reports a case in which this occurred and led to fatal peritonitis. A patient of my own had a narrow escape from a similar fate. Within a few days of the operation the wound opened as the result of a virulent and rapidly spreading infection. Small intestine and the front of the uterus were exposed. From the appearance of these structures I am convinced the infection was in the first place confined purely to the abdominal wall. In another in whom there was also evidence of severe uterine infection, widespread suppuration occurred in the fatty layer, with complete separation of the skin edges. This is only one of many remarkable instances where uterine and abdominal wall infection have been present together while the peritoneum, which must have been temporarily impregnated with the same organisms, has entirely escaped.

In clean cases operated on before the onset of labour primary healing of the abdominal wound is almost the invariable rule. Suppuration, when it occurs, is associated almost entirely with those patients in whom labour has been in progress many hours, the membranes have been ruptured some considerable time, and examinations or other vaginal manipulations have been made. The frequency of its occurrence in any statistics is, in some measure, a useful indication of the type of case on which the surgeon is accustomed to operate. In Brouha's series 73 per cent of suppurations occurred in patients in whom the membranes had been ruptured more than

four hours. In 53 per cent of abdominal wound infections there was coexistent intra-uterine sepsis. Mirassou (quoted by Mahon) found that in 17 cases of infection of the abdominal wound the average time which had elapsed between rupture of the membranes and operation was twenty-six hours

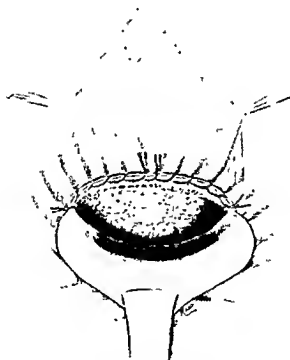


Fig 77—The edges of the slit in the rubber dam are united by suture to the edges of the incision in the uterovesical peritoneum. The wound and peritoneum are protected from infective 'spill' and also mæconium, which is intensely irritating. (Rubovits *et al*)

Mahon has reviewed the methods which have been adopted to prevent this inconvenient complication. Pouring ether into the wound, changing gowns, gloves, and instruments before proceeding to closure, drainage of the wound with tubes or strands of silkworm gut, careful protection of the incision with towels or rubber during evacuation of the uterus—all these and other precautions met with not the slightest success either in his own hands or in Brouha's.

Mahon finally found that closure of the abdominal wall in one layer completely abolished wound suppuration. Twenty-five suspect or infected cases were so treated between 1931 and 1933, and during that period infection of the abdominal incision never once occurred. One of his patients succumbed to peritonitis on the twenty-third day, and the wound was proved to have healed throughout by first intention.

Schmieden has recently considered suppuration and breaking down of the midline abdominal incision from the standpoint of the general surgeon. The condition is due to several factors—the natural ischæmia of the midline structures, the formation of hæmatomata in the preperitoneal tissue, and the use of the continuous suture line. The employment throughout of interrupted ligatures would be better, this method permits ready seepage of blood or serum either backwards into the peritoneal cavity or forwards through fascia and skin.

I have not followed Mahon's advice, and can only make the following suggestions —

- 1 Disturb the fascial planes as little as possible
- 2 Do not encroach upon the fatty tissue of the mons veneris
- 3 Ensure careful hæmostasis
- 4 The lower angle of the wound may be protected by temporarily uniting the parietal peritoneum to the skin in this region

5 Gross contamination of the wound edges can be prevented by adopting Leon's procedure. I have devised a method which is somewhat similar and may be of value. In a sheet of thin rubber dam a slit is cut corresponding in length to the incision in the utero-vesical peritoneum. The edges of the slit are united by clamps or suture to the peritoneal edges. The abdominal cavity and the wound are thus excluded.

6 When closing the parietal peritoneum, lay aside the suture after knotting, and tie it later to the lower end of the fascial suture. This helps to obliterate the preperitoneal and prevesical space in the lower angle of the wound.

DELIVERY OF THE PLACENTA PER VAGINAM

Some believe that this is preferable to delivering the placenta and membranes across the peritoneal cavity in suspect or infected cases. This practice seems to be founded on two assumptions

- (1) That the placenta and membranes are more highly infective than

the fœtus or liquor amnii; and (2) That manual removal is commonly the only way of treating the placental stage. The former I cannot believe, the latter is untrue.

Evers followed the above course in 15 cases, but having had to remove the placenta per vaginam in one patient, he has since given up this practice

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CHAPTER VI

DOERFLER'S OPERATION: THE LOWER SEGMENT OPERATION ON THE EVENTRATED UTERUS

SINCE 1929 Heinrich Doerfler of Regensburg has ceaselessly urged upon his German colleagues the adoption of this form of Cæsarean section. According to himself its essential and inseparable features are (1) *Eventration of the uterus*, (2) *A transverse uterine incision*, (3) *Simple manipulations performed entirely with the hand*.

Technique—The technique here set out closely follows Doerfler's own description—

Ether anaesthesia is not begun until operator assistants and instruments are in complete readiness. The abdomen is then prepared with benzine and iodine. The Trendelenburg position is not used. The leg pieces of the table are dropped and the lower abdomen is thus brought into greater prominence.

Abdominal incision. Median from symphysis to a point in the linea alba a little above the umbilicus. The uterus is eventrated and held well forward by the surgeon while the second assistant places half of a large abdominal pack deeply into the pouch of Douglas and spreads the remainder behind the uterus over the abdominal wall. Over this more towels are heaped and the uterus is then laid back upon the mother's body. With his right hand the assistant brings the head into the midline above the symphysis and clasps the cervix from behind in a firm hæmostatic grip.

The uterovesical peritoneum is divided transversely from one round ligament to the other. Owing to the tension and bulging of the front of the lower segment the lower peritoneal flap and bladder fall away to the level at which the latter obtains a firm attachment to the cervix.

The uterine incision is made directly transverse, the deeper layers of the uterine muscle being divided with the back of the scalpel in order to avoid injuring the child. The membranes presenting in the wound are quickly ruptured, the hand is inserted and delivery is effected with this alone.

From the beginning of the anæsthetic only some 7 to 10 minutes have elapsed. In consequence of compression of the cervix by the assistant's hand hardly any blood has been lost.

The third stage. Immediately following the delivery of the infant an intra uterine injection of pituitrin is given. The placenta usually appears spontaneously or with the help of some fundal pressure. Introduction of the hand is only exceptionally necessary. Another

injection of pituitrin is given. The uterine incision is now only one-half or one-third its original length. Surgeon and assistants change their gloves, and over the soiled towels fresh ones are laid.

Suture. As this is begun ergot is injected into the thigh muscle. If bleeding persists, the compressor hand is reapplied to the cervix. The deeper muscle and endometrium are included in the first suture line. The second takes up the superficial muscle and the loose uterovesical peritoneum. These two suture lines are buried by a third and even fourth suture—both of which are seroserous.

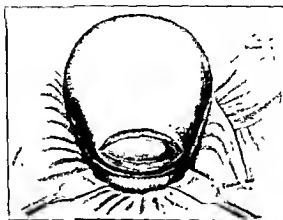


Fig. 7.—Doerfler's operation. The uterus is clasped from behind in the assistant's right hand which is passed beneath the towels into the pelvis.
(Redrawn from Doerfler.)

All towels are now removed. No blood or liquor has entered the peritoneal cavity. The uterus is replaced and its degree of retraction observed for a few minutes. If found relaxed contractions are aroused by gentle tapping with a broad flat metal instrument.

At signs of returning consciousness a hypodermic injection of morphine and atropine is given.

Advantages Claimed.—Doerfler has claimed many advantages for his operation, and their merits must be briefly examined:—

1. *Seven hundred operations over a period of thirty-eight years have never produced an early or late rupture of the scar. In numerous repeat operations he has failed to discover any weakness or deficiency in the scar.* Unlike the great majority of German obstetricians Doerfler is one of the very few who have throughout remained faithful to the transverse incision of Kehrer. More recently he has been able to justify this practice in the light of Goerttler's work.

2. *No other method of Cæsarean section offers such safety for the infant.* Three of the infants who died showed signs of asphyxia

before the operation. The fourth died from a tentorial tear, the result of stormy uterine contractions. The fifth was an anencephalic monster. As Doerfler operates on patients with eclampsia and placenta prævia it is possible that these figures represent only a reduced mortality.

There seems to be little doubt of the ease and speed with which the head can be delivered by Doerfler's method. Buschbeck, with an extensive experience of the operation, offers his independent assurance on this point. Richter maintains that infants are lost owing to failure to evert the uterus.

3 *Infection of the abdominal wound has practically never occurred.* This may be accepted either as a point in favour of his technique or, less charitably, merely as evidence of the type of patient upon which he most frequently operates.

4 *Post operative morbidity.* "Pathological consequences have with the rarest exceptions been entirely absent, and so, in this regard, statistical details are necessarily lacking" (Doerfler). But in the absence of sufficient information we are equally entitled to assume that when his patients come to operation their condition is extremely favourable.

5 *"Our simplified Cæsarean section, performed at the right time or preferably as an early operation, is the simplest, least dangerous, speediest, easiest, and most aseptic of all methods."* Doerfler has experienced three fatalities. The first, a clean patient, succumbed to peritonitis and suppuration of the abdominal wound. The second and third occurred in a series of 18 more or less infected cases among the 107 patients on whom Doerfler had operated during the past 10 years. One died of severe sepsis, the other of peritonitis. This series of 18 is the only one he definitely indicates as "more or less infected, all feverish, and some having undergone attempts at vaginal delivery." The mortality of this group, totally inadequate for any final decision, is therefore 11.1 per



Fig 79 —Sagittal section from uterus removed by supravaginal amputation immediately after performing Doerfler's operation. The thinner lower segment and the partially separated presagittal peritoneum are shown.

cent. Further, in one place he confesses that frankly infected patients in whom the child is still alive are subjected to Cæsarean hysterectomy. Yet no figure is offered to indicate the frequency of such an operation. Engelmann has also offered this criticism. Doerfler's writings do lack much of that pleasing informativeness which we have so naturally come to expect from his countrymen. But this alone is no sufficient reason for condemning his operation.

Other Reported Cases.—Eisenberger has reported 50 cases, of whom 19 were admitted after rupture of the membranes. Vaginal examinations had been made in all. In two instances attempts to deliver with forceps had failed, in three version had been unsuccessful, and fever (in several cases with rigors) was present in the majority. Doerfler's technique was followed with two minor departures: the protective compresses were soaked in rivanol (1-1000), and the uterus was irrigated with this solution. Four of his patients died—one from a cardiac lesion, three from peritonitis. Thus in his group of suspect or infected cases the mortality from sepsis was 15 per cent.

Since 1931 von Jaschke has put the eventration operation to an extensive test in his clinic at Giessen, and Rossenbeck (1936) has compared the results with those previously obtained from the Opitz procedure (vertical incision in the cervix and lower segment, uterus

Table I—MORTALITY (Rossenbeck)

METHOD	NO OF CASES	MORTALITY			
		ABSOLUTE	PER CENT	REDUCED	PER CENT
Section and subtotal or total hysterectomy	35	6	17.1	4	11.4
Classical section	46	6	13.1	4	8.7
Cervical section (Opitz technique)	243	15	6.2	4	1.6
Doerfler section (up to March 31, 1936)	158	3	1.9	1	0.6

Table II—MORBIDITY (Rossenbeck)

METHOD	NO. OF CASES	UNCOMPLICATED PYEMIA		POST-OPERATIVE COMPLICATIONS			
		Absolute	Percent	Absolute	Percent	Reduced	Percent
Opitz	243	92	37.9	151	62.1	118	48.5
Doerfler	158	80	50.6	78	49.4	54	34.2

in situ) Morbidity of *genital* origin, 8.5 per cent after the Opitz operation, fell to 2.5 per cent in the Doerfler series, foetal mortality (reduced) was reduced from 6.3 per cent (Opitz) to 2.5 per cent (Doerfler) For the present they reserve judgement on its worth in unclean cases, as they consider the available material is too small Von Jaschke believes the value of the operation rests rather on the transverse uterine incision than on any of its other features Spinal anaesthesia was used throughout, the additional relaxation permits a smaller abdominal incision This surgeon's experience should also serve to dispel any anxiety that might be felt with regard to even trating the uterus under this form of anaesthesia (*Tables I and II*)

Rossenbeck's communication gave rise to an interesting discussion at the ninety sixth session of the Middle Rhine Society for Obstetrics and Gynaecology (1936) Some useful figures emerged, shown in *Table III*

Table III—COMPARISON OF DOERFLER SECTION AND SECTION IN SITU

RECORDER	DOERFLER SECTION	MATERNAL MORTALITY PER CENT	SECTION IN SITU	MATERNAL MORTALITY PER CENT
Thoma	125	1.6	—	—
Haupt	150	0.6 (reduced)	250	1.2 (reduced)
Buschbeck	173	9.2	80	5
Munnekehoff	—	—	184 (transverse uterine incision)	1.6

Naturally Buschbeck is dissatisfied with the operation Nor is Schmidt von Elmendorff impressed with the necessity for eventration In his clinic (Dusseldorf) 466 intra-abdominal cervical sections were performed with a total mortality of 1.5 per cent No death occurred in 196 clean cases He sees no reason why he should change his practice Puppel found that the act of eventration gave rise to severe shock in two of his patients

Probably many are deterred from adopting the operation on account of the length of incision supposed to be necessary Thoma, however, maintains that it need never extend more than two to three finger-breadths above the umbilicus Wahl has recently shown how it may be still further reduced by using an incision which extends from a hand breadth above the symphysis to a short distance above the

navel. While the upper angle of the wound is spread by two abdominal specula the uterus is eventrated by pressure in the flanks. The lower angle is then drawn down with the usual retractor, thus making it possible to perform the typical Doerfler procedure.

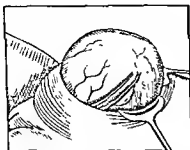


Fig. 80.



Fig. 81.

Wahl's method of eventrating the uterus. the incision is thus kept as short as possible. (*Redrawn from Wall.*)



Fig. 82.—Showing length of healed incision after Wahl's method of eventrating the uterus. (*Redrawn from a photograph by Wahl.*)

Conclusions.—An estimation of the true worth of Doerfler's operation must for the present be deferred. It can be decided only by experiments on a scale such as von Jaschke has planned, and the one now in progress at Koln (Naujoks, *Table IV*). In this country Munro-Kerr has recently suggested that eventration should be seriously considered, and Green-Armytage has stated that he employs it in infected cases. Stoeckel confesses that, as yet, he is unable to regard eventration as a technical advantage. It would appear, however, that the transverse incision has made a distinguished convert, for he goes on to state: "I hold this incision to be a definite advance. It

Table IV—RESULTS OF DOERFLER SECTION (*Naujoks and Wahl*)

TYPE OF OPERATION	EXTRA PERITONEAL	INTRA PERITONEAL	DOERFLER
Number of cases	394	152	111
Maternal mortality—Reduced	2.2 per cent	2.6 per cent	1.9 per cent
Unreduced	4.3 per cent (4 due to peritonitis)	5.9 per cent (2 due to peritonitis)	6.4 per cent (None due to peritonitis)
Fœtal mortality	3.5 per cent	4.6 per cent	3.8 per cent

simplifies the technique, makes extensive mobilization of the bladder unnecessary, and guarantees that the incision is really cervical, and that it will remain so even if the wound extends during delivery of the infant "

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CHAPTER VII

THIRD STAGE: HÆMORRHAGE AND OXYTOCICS

WHILE the danger of bleeding has steadily receded into the background, it must still be regarded as the greatest single risk of the actual operation. Apart from all those influences which may operate in any form of delivery, the amount of blood lost during the third stage will generally be governed by the following factors:—

1. *The relation of the time of operation to the onset and duration of labour.* The incidence of abnormal hæmorrhage has been greatest in those patients in whom prolonged labour, uterine inertia, and maternal exhaustion have been followed by the administration of a general anæsthetic. The best retraction has ensued in those operated on not too late in labour and in whom the pains have been normal and regular. The behaviour of the uterus in patients delivered before the onset of labour is variable, but seems, on the whole, to resemble more nearly that of the latter group. While these are purely clinical impressions, they are, in the main, borne out by the more exact observations of Dieckmann and Daly.

2. *The nature of the anæsthetic selected.* The subject of hæmorrhage and the question of anæsthesia are, in my experience, inseparable, and the reader is referred to what has already been said on this matter.

3. *The manner in which the birth of the child and the delivery of the placenta are conducted.* The importance of this outweighs everything else, and I would again urge a course which experience has convinced me is the right one.

a. If the patient is under general anæsthesia give an intravenous injection of pituitrin diluted in 4 c.c. of saline immediately the head is born. I began by using 0.5 c.c. (i.e., 5 units), but even half this dose appears to produce the same effect. Alternatively, inject 0.5 to 1 c.c. of pituitrin into the uterine muscle as soon as the head has escaped. While experience has shown that such injections are rarely necessary when the operation is performed under spinal or local anæsthesia, it will at least be a wise precaution to follow the latter course even in these cases.

b Be prepared to allow the head to rest on the pubes for as long as 3 minutes. This will frequently be unnecessary, as the child will begin to move within twenty or thirty seconds, and the trunk appear spontaneously, as the result of a contraction. During the pause no bleeding occurs from the uterine incision, as this is prevented by the retraction occurring in its edges and by the pressure of the shoulders.

c Now grasp the head and spend another half minute in extracting the trunk and legs. When the breech presents I deliver with the same deliberation and patience as I would were the buttocks presenting at the vulva. Slow delivery, permitting the uterus to adapt itself, has been shown by Dieckmann and Daily to be an important factor in reducing the amount of blood lost in Cæsarean section.

d Wipe away the membranes and begin the suture in the far angle of the uterine wound. The placenta will generally appear within a minute or two. If it does not do so it is expressed by pressure on the fundus through the abdominal wall and lifted by the cord through the uterine incision. The membranes are twisted off the uterine wall and the suture immediately continued. At no time should the uterus be lifted out of the abdominal cavity.

Routine manual removal of the placenta cannot be too strongly condemned. Manual removal is carried out only in the following circumstances —

i When partial separation and bleeding occurs which does not immediately respond to fundal massage and expression.

ii When, though there is no bleeding, an attempt to express the placenta has failed after a reasonable period of waiting.

iii In certain cases of placenta prævia.

In suspect patients the intra-ovular method of separation is preferable to passing the hand between the uterine wall and the placenta. It is just as easy, for the greater part of the placenta is frequently found to have separated and to be retained chiefly by the adherent membranes. In every instance the surgeon himself should inspect the placenta carefully before handing it over to the nurse.

Per Vaginam Delivery of the Placenta—Klumper (1926), Stoel (1933), and de Snoo (1936) are among the few who still advocate that the uterine and abdominal incisions should be closed and the placenta delivered later through the natural passages. Klumper found that the loss of blood was greatest following *manual removal* and least when the above procedure was followed. De Snoo treated

44 cases in this manner and came to the same conclusion. In two cases, however, he had to remove the placenta manually. I strongly disagree with such a practice. In the first place one of the advantages of Cæsaean section is immediately lost—the possibility of being able to exert complete control over the third stage through the open abdominal incision. Second, it can be used only in selected cases in which the cervix is dilated to at least 4 cm. (de Snoo). Third, if abdominal expression or manual removal later becomes necessary, the former cannot be good for the abdominal wound (Gilliat), while the latter must necessarily cause considerable stretching and disturbance of the freshly sutured incision in the lower segment. Finally, if the course I have sketched above is studiously followed, the loss of blood will rarely be found to exceed that accompanying any normal delivery, and indeed, on most occasions will actually be less.

My own unhappy experiences with hæmorrhage in the earlier cases under general anæsthesia led me to believe that immediate manual removal of the placenta was an urgent necessity. This practice I continued unthinkingly and quite wrongly for a short time after passing over to spinal anæsthesia.

POST-PARTUM HÆMORRHAGE

Some degree of uterine atony is not always avoidable. There is no occasion for dismay. It should be met at once by measures which are simple yet effective. 'Trial and error' methods may cost a life.

1. Arouse a contraction by massage of the fundus through the abdominal wall, and place a hot saline towel in the cavity of the uterus.

2. Inject 5 units of pituitrin intravenously. If this drug has already been employed, do not repeat the injection but give ergometrine in the same way. The latter may always be safely repeated. As an alternative the injections can be made into the rectus muscle; absorption by this route is probably more rapid than that from the wall of the emptied uterus.

3. As soon as the uterus begins to contract, the towel is removed and the uterus should be packed. Dry gauze, 12 in. in width, has advantages. The end can be pushed through the cervix and the gauze withdrawn later, or it can be removed just before the first uterine suture is completed. McIlroy suggests the use of a large abdominal pack soaked in glycerin. Very many operators regularly

pack the uterus as a precautionary measure in all their operations. Others insist that its employment should be universal in cases of placenta prævia (Schumann)

4 Proceed with the closure of the uterine incision as speedily as possible. Better retraction always seems to follow the completion of the first suture line.

In only three cases have I actually packed the uterus, in two the gauze was removed before the uterine wound was closed.

I can hardly believe these measures will ever fail to control bleeding and induce retraction of the uterus. Calamities occur only because packing is resorted to when so much blood has been lost that the issue is already in grave doubt. But deaths are unfortunately still recorded either from loss of blood alone or the superadded shock of hysterectomy. Whether this latter step is ever necessary, or at what moment it should be undertaken, I am not in a position to discuss. It must remain a matter for the quick and individual judgement of the operator. I have once resorted to hysterectomy on this indication, but even here I was influenced by other aspects of the case (*Case 233, Chapter X, table I*).

All danger is not past when the patient leaves the theatre. I have had two patients of my own, and know of several others, in whom dangerous and, on one occasion, even fatal relaxation of the uterus occurred after return to the ward. One of them I sent from the table with the uterus empty of all clot and firmly contracted. One hour later I was called to see her as slight vaginal bleeding was occurring, pallor increasing, and the pulse deteriorating. The fundus of the uterus was a hand's-breadth above the umbilicus, and I was able to express a pint and a half of blood and clot. Fortunately she had lost practically nothing during the operation.

It might be wiser to send these patients from the theatre with the abdominal wound covered *only* with a sterile towel. Any tendency for the uterus to relax and fill up with blood could then be more readily detected. At all events it should be the sole duty of one nurse to remain at least for two hours with any woman who has undergone Cæsarean section.

OXYTOCIC INJECTIONS

Nearly all operators avail themselves of these preparations, but there is no general agreement as to the moment when they should be introduced or the route by which they should be injected.

Intravenous Pituitrin.—This has found considerable favour. DeLee has praised its use as a means of reducing hæmorrhage during manual removal of the placenta. Bohler and Reiles, Heffernan, Stevens, Vaccari, and others report excellent results since adopting this route of injection in Cæsaean section. Schmidt v. Elmendorff's experience merits particular notice. On account of the interference of general anæsthesia with uterine tone, spinal anæsthesia was preferred in 255 sections. The operations were almost bloodless, and retraction excellent, though oxytocic injections were omitted. But after experiencing two deaths from respiratory paralysis, this surgeon reverted to pure ether anæsthesia, giving 1 c.c. of pituitrin immediately after the delivery of the infant. The results were gratifying, bleeding being very much diminished in a further series of 127 operations. Bohler and Reiles obtained excellent and immediate retraction in 40 patients delivered under ether anæsthesia.

Bassmann states that no unpleasant effects need be feared from such an intravenous injection in anæsthetized patients. Stoeckel employs it as a routine in association with uterine packing. Green-Armytage gives 1 c.c. in those potentially infected patients in whom he desires to deliver the placenta per vaginam. The dose frequently recommended is 10 units diluted in a few cubic centimetres of saline, and is injected either following exit of the head or complete delivery of the child. With much smaller doses I have obtained equally impressive results. Certainly its adoption has done much to lessen my fears on those rare occasions when I feel compelled to revert to general anæsthesia.

This method of injection is not new. We go back to Baisch, nearly twenty years ago, for one of the first authoritative statements on its value :—

“Cæsaean section in the absence of pains is considered dangerous by many; above all atonic bleeding is feared. In our experience such fears are groundless; on the contrary, bleeding on these occasions has been extraordinarily slight. Admittedly for a long time now we have given as the uterus was being incised 2 c.c. of pituitrin intravenously. The effects of such injections are striking and immediate and with a few exceptions completely successful. The uterus contracts so energetically that the placenta is born spontaneously through the uterine incision. This injection has become an integral part of our Cæsaean section technique, and since its introduction we have neither had to pack the uterus nor take refuge in more radical measures such as hysterectomy.”

There is a faint doubt as to whether such injections of pituitrin are entirely safe. Occasionally, as Ryder and others have experienced, patients are met who display a hypersensitiveness to pituitary extract. Pastore, who gave pituitrin intravenously to 96 patients in the third stage of labour, believes that it *may* have been responsible for the death of one woman. His dosage seemed unnecessarily large. For those who fear the appearance of 'pituitary shock', the use of pitocin can apparently be recommended. Given in small quantities (0.15 to 0.5 cc) it brings about strong retraction within two or three seconds (Douglass et al.)

Intravenous Ergometrine.—Having few undesirable effects, this drug may be given with safety in cardiac or renal patients in whom there is reason to fear the possible action of pituitrin on the circulation or renal function. It is probable, however, that it may soon entirely replace pituitrin. Davis is the only writer I can discover who has set down his experience of 'ergotocin' in a series of Cæsarean sections. To 24 patients 0.25 mg. was given intravenously as the baby was being delivered through the uterine incision. "In all of these cases the uterine muscle contracted firmly, the uterine wall became blanched, its contractions drew the peritoneum into small folds spread over the surface of the uterus. These changes show clearly the marked tetany and contractility of the uterus. The placenta was detached smoothly from the uterine site and was gradually pushed into the incision with partial extrusion which could easily be completed by traction on the cord or lifting it out manually."

If Davis operated under general anaesthesia his results offer the strongest possible evidence of the usefulness of this drug in Cæsarean section. If he did not they *prove* very little, for he has offered almost a perfect description of the sequence of events which I have been able to demonstrate in eight out of ten cases delivered under local or spinal anaesthesia *without any form of oxytocic injection*. The comparative potencies of these drugs in Cæsarean section will be determined only by their exhibition in a large series of patients operated on under general anaesthesia.

The intravenous dose of ergometrine usually given in this country is 0.125 mg., but it appears that this is a minimal dose, as the drug has a considerable margin of safety.

Intramural Injections.—Dieckman and Daily stress the efficacy of pituitrin injected directly into the uterine wall immediately following delivery of the head. Ergometrine may also be given in this way.

Owing to the great vascularity of the uterus at this moment such injections may, for all practical purposes, be regarded as intravenous.

Cambon, who has returned to general anæsthesia after experiencing a fatality from spinal anæsthesia (p. 65), has successfully reduced the amount of hæmorrhage (incisional and third-stage) in a series of 33 patients by the use of pituitrin and 'ergostinin'. Ten units of the former is injected into the uterine wall and 0.5 mg. of the latter given subcutaneously just before making the uterine incision.

Intramuscular Injections of Pituitrin and Ergot Preparations.—This route is probably still more commonly chosen than any other. Usually, however, these injections are given too late in the operations, enough consideration not being given to the time which must elapse before they can exert their action on the uterine muscle. The single or combined injection should be made certainly not later than the moment when the surgeon is beginning to incise the skin. Le Lorier and Maurice Mayer recommend that these drugs should be administered together at the commencement of anæsthesia, and support their contention by the results obtained in a well-controlled series of 62 operations. In no case was delivery of the child embarrassed by exaggerated uterine tone.

Ergometrine can also be administered by this route. Moir expresses the opinion that its action will be variable when Cæsaean section is performed on the uterus which is not in labour. I have not found this to be so in the small number of cases in which I have employed it; once a uterus is incised it is difficult to distinguish its reactions to this and similar drugs from those of the labouring organ.

In my own judgement the most certain, rapid, and effective response is obtained from the intravenous or the intramural injection of these drugs.

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CHAPTER VIII

PLACENTA PRÆVIA AND THE LOWER SEGMENT OPERATION

"Reluctance to adopt measures which seem radical has no doubt in some instances served to retain a proper balance of obstetric procedure. However, in other instances it has retarded progress and definitely caused the continuation of high mortality by encouraging adherence to obsolete methods" (ARTHUR H. BILL).

Historical.—"After the unlucky attempts of the Americans Harris, Sachsinger, and Sligh, it fell to the German, Lodemann, to be the first to perform Cæsarean section with success in the presence of placenta prævia. He operated on account of osteomalacia and only stumbled upon the condition by chance. In 1894 Bernays, again an American, was the first to perform the operation deliberately for placenta prævia and be rewarded with a living mother and living child. On the same grounds Hyles, Hurburt, Gilette, Hare, and Carbonelli attempted the procedure, but with a fatal outcome in every instance. However, Lawson Tait, in 1899, was more fortunate, and using the Porro operation was able to save his patient. The beginning of the present century found the Italians, Carbonelli, Stradiotti, and Pestalozza enthusiastic for the method, while in 1908 Krönig and Sellheim came forward as energetic advocates of Cæsarean section in the treatment of placenta prævia" (Küstner).

INTRODUCTION

The following figures of placenta prævia, which cover a period of twelve years, have been taken from the records of the Liverpool Maternity Hospital:—

	NUMBER OF CASES	REDUCED MATERNAL MORTALITY Per cent
1926-1931 ..	179	7.6
1932-1937 ..	278	2.51
Treatment.—		
Vaginal delivery ..	326	6.1
Cæsarean section ..	122	1.6
		(unreduced)

Twenty of the 23 deaths must be attributed to the condition of these 30 per cent were due to infection and 70 per cent were the result of hæmorrhage or hæmorrhage plus the shock of anæsthesia and manipulations

The outstanding feature of the above table is the notable reduction in the maternal mortality during the more recent period This can in a large measure be ascribed to the following causes —

1 Increasing Number of Blood Transfusions—Until 1930 no patient with placenta prævia appears to have been transfused During the whole of the earlier period transfusion was used in only 2.9 per cent of cases Since 1932 however the incidence has risen to 10 per cent and this measure alone has been responsible for saving many women But one point must be stressed here *too many transfusions were given not because of the poorly condition of the patient on admission but because they became necessary either as the result of vaginal manipulations or the unforeseeable consequences of delivery through the natural passages*

2 Decreasing Use of Version—Scalp traction (Willest's forceps) was introduced for the first time in 1932 It can be resorted to earlier than version the manipulations are generally easier and the forceps can be applied with less loss of blood

3 More Immediate Treatment—Since 1932 the hospital has been served by a succession of resident obstetricians In the management of the more urgent of these cases their presence has proved invaluable

4 Higher Standards of Obstetric Practice—There has been the clearest evidence that wider and wiser teaching and better antenatal instruction have resulted in the earlier admission of these patients to hospital without any previous vaginal interference

5 Increasing Resort to Cæsarean Section—In the former period 16 per cent in the latter 33 per cent of all cases were delivered by abdominal section During 1937 the rate rose to approximately 50 per cent

REDUCTION OF MORTALITY IN PLACENTA PRÆVIA

GENERAL PRINCIPLES

Hospital versus Domiciliary Treatment—Every obstetrician who elects to treat such a patient in her own home or even in a partially equipped institution accepts a very grave responsibility The

well-appointed hospital, using only those methods of treatment which are available in general practice, will still show a mortality which is quite one-third or less of that obtained outside its walls (Pankow). The advantages of hospitalization cannot, therefore, be too often displayed. Mikulicz-Radecki has set them out thus :—

1. If the bleeding occurs during pregnancy and is only slight, an expectant attitude may possibly be adopted in the first instance

2. If in consequence of bleeding urgent intervention is indicated, preparations for Cæsarcan section can quickly be made, the patient then examined vaginally, and the most suitable form of treatment decided upon.

3. Cæsarcan section, the best method in many cases, can be immediately carried out

4. For dealing with such complications as cervical lacerations, uterine atony, etc., the hospital provides expert attendance, good lighting, and the necessary instruments.

5. Blood transfusions, intravenous infusions, etc., are made immediately available to the severely anæmic woman.

Diagnosis.—Hæmorrhage in the later months of pregnancy or early labour occurring in a woman who is otherwise well should be regarded as due to placenta prævia. Any attempt to elucidate the diagnosis still further cannot be too strongly deprecated. *Every examination arouses bleeding, every examination increases the risks of infection.* Vaginal plugging is rarely necessary, always undesirable, and only in a few cases really pardonable. Transport to hospital should straightway be arranged, and the husband and other available adult relatives should accompany the patient. It is very common to find among them one whose blood is of a suitable group. This at once places the patient in a position of greater security.

Preliminary Measures after Admission.—The patients to whom I would mainly refer constitute a definite group, and, what is of great importance, the group which furnishes the bulk of the fatalities. Nearly all are in the last few weeks of pregnancy. The majority are not in labour, though in a few, pains may have set in since the onset of bleeding. Most of them give a history of one or two ‘warning’ losses which they have ignored or concerning which they have been badly advised. Suddenly a brisk hæmorrhage has overtaken them, which, on admission, may have ceased. But in some blood may still be trickling away, in others an occasional clot is extruded from

the vagina. The foetus is almost invariably the
of practical experience usually proves to be

It is best to proceed systematically. The
that has been followed in the Liverpool Maternity Hospital since
1932

1 *As soon as the patient arrives or even earlier if we have been
warned to expect her preparations for Caesarean section are made.*
When we have been informed that her condition is serious a Group IV
donor is immediately summoned. Our hospital organization also
offers speedy facilities for transfusing exsanguinated patients prior to
removal from their homes. While advantage has been taken of
these on many occasions they have not so far been requested in
a case of placenta praevia.

2 *The patient's blood is grouped while the preliminary nursing
measures are being carried out (rectal toilet, catheterization, etc.)* If
time permits a cross agglutination test is made. Omission of this
was nearly responsible for the death of one of our own patients.
After some days of haematuria, oliguria and drowsiness she gradually
recovered. It was proved that one of the grouping sera was com-
pletely inactive. Hendry and Baird owe the sole fatality in their
last eighty-seven Caesarean sections done for placenta praevia to an
error in the test for compatibility of bloods.

3 *The clinical condition of the patient is estimated from her colour,
the quality of the pulse and the blood pressure reading.* The results
of these examinations may be so good as to make the blood grouping
appear an unnecessary precaution. But this step must never be
omitted, as it is impossible to foresee what dangers may yet have to
be faced before delivery is complete and the uterus firmly retracted.
When transfusion is urgently indicated the task is at once deputed
to an assistant. On the rare occasions when there is undue delay
in obtaining a donor I believe that an infusion of 5 per cent glucose
is preferable to gum acacia in saline for patients who may have to
be anaesthetized.

4 *A careful abdominal examination is made.* I would lay the
greatest stress on this: the physical signs elicited will often entirely
justify the elimination of any further examination.

The practice sketched above differs only in minor details from
that followed in many well equipped and fully staffed hospitals. It
should always precede the vaginal examination or any form of opera-
tive intervention. The practical details need not be gone into at

length. There is, however, one way of proceeding which I have found of service in dealing with the very anæmic woman :—

Immediately after admission a vein in the arm is exposed and a cannula tied in. This is connected to a drip-infusion apparatus containing some ounces of 5 per cent glucose. The rate of flow is maintained at about 40 drops per minute until the blood is available, which is usually some 20 or 30 minutes later. When the veins are not too collapsed a Luer-Kaufmann syringe and needle are used in preference to cutting down on a vein.

In this way we can be sure that the apparatus is working smoothly and that the real transfusion will proceed without hitch or delay.

Hendry and Baird have clearly demonstrated how a carefully planned and well-organized approach to these patients will win immeasurably better results. Their paper should be read.

THE WAYS IN WHICH CÆSAREAN SECTION CAN BE MADE SAFER

Omission of the Vaginal Examination.—If it can be admitted that for a large number of these patients abdominal delivery will be the ideal course, then every unnecessary act or intervention should be ruthlessly omitted. Few experienced obstetricians will contend that digital palpation is really *essential* to the diagnosis of a placenta prævia in that class of patient we are at the moment considering. The history alone enables the junior house surgeon in his first few months of residence to diagnose the condition with almost 100 per cent accuracy. The history, audible heart-sounds, the presence of a malpresentation or *less obvious deviations from the normal lie*, the nature of the bleeding, the absence of those symptoms and signs which point almost as unmistakably to an accidental hæmorrhage—these together form a chain of circumstantial evidence which puts the diagnosis “beyond all reasonable doubt”. I therefore now omit vaginal examination in nearly all those patients whom I intend to deliver by Cæsaean section. What is possibly missed by this? A carcinoma of the cervix, a cervical polyp, a ruptured vaginal varix, and a few other rarities. The chance of the bleeding arising from any one of these is very remote, and it is even more unlikely that any one of them will be associated with the typical history and the suggestive abdominal evidence of placenta prævia.

On the other hand, by omitting digital exploration of the cervix and placenta we eliminate the risk of infection; we save the woman a loss of blood; finally, we sometimes avoid a furious hæmorrhage

which would compel the adoption of temporary or permanent vaginal measures in a case for which they may prove eminently unsuitable I could quote several examples from my own experience where this has happened. Instead I refer to Hendry and Baird. "In 7 cases, following vaginal examination in hospital, hæmorrhage resulted and was so severe as to require immediate packing. In all of these Cæsarean section was performed immediately afterwards with excellent results."

The disadvantages of preliminary vaginal interference are also clearly exposed in the following statement by Lloyd and Giessen. "The examination was made very carefully, the state of the cervix being noted and the lower uterine segment gently explored with the examining finger. Subsequent procedure varied according to the findings. If a central placenta prævia was diagnosed, Cæsarean section was the routine method of delivery, and if bleeding occurred at the examination the vagina and cervical canal were packed with gauze until it was controlled by direct pressure. Counter pressure was effected by a tight abdominal binder and a T-shaped perineo-abdominal bandage. The condition of the patient was as a rule adversely affected by a combination of hæmorrhage and shock resulting from the operation of plugging. The next step was to restore the general condition of the patient by morphine and blood transfusion. When this was considered satisfactory Cæsarean section was performed irrespective of the state of the fœtus."

However all this is regarded, it must be admitted that these patients have been treated twice, once vaginally, and once abdominally. The ideal has not been reached. The prognosis has been changed, and in one hundred such cases it would show itself in figures. Caffier in his paper on the exsanguinated patient has heavily underlined the great dangers associated with the vaginal examination. Rectal examination is no alternative, he states, for it is the risk of bleeding and not the introduction of infection which is most to be feared. It is the super-added effects of *several* hæmorrhages that so often leads to a fatal outcome, it is hardly right that the obstetrician himself should wittingly and deliberately give rise to one of these. In stressing the importance of all this I am glad to find that I have the support of Bill. "We never attempt to make a diagnosis by vaginal examination. While the diagnosis of placenta prævia made in this way is of course not as certain as if one inserted the finger into the os and actually felt the placenta, it is vastly more important to avoid all vaginal examinations than to make an accurate diagnosis of the variety of placenta prævia."

The above principles can also be acted upon in our antenatal work with great benefit to our patients. As an example: Twice within recent months when I have been led to suspect placenta prævia purely on abdominal signs (*Figs 83, 84*), the patients were warned that if the slightest bleeding occurred they were to refuse all vaginal examinations and report the fact immediately. Slight bleeding did occur, and I was able to perform Cæsarean section in the very best conditions. Needless to say other women have received similar warnings and nothing has happened, but no harm has been done.

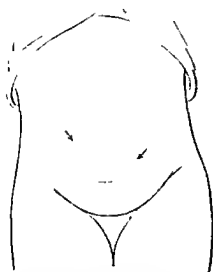


Fig 83—Condition met in a number of cases of central placenta prævia. The fully flexed fetus lies high in the abdomen. A cushion like resistance is met on gently attempting to impress the head into the brim.

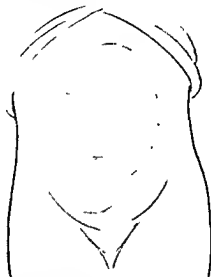


Fig. 84—One-third of all cases of placenta prævia are associated with breech, transverse, or face presentations. In at least another third there will be present less marked deviations from the normal lie: these will escape notice unless the abdominal examination is carefully conducted. (*See placenta prævia results, Chapter X.*)

In what circumstances, however, is a vaginal examination recommended and in what conditions will a vaginal method of treatment probably be chosen? The case with which the latter can be carried out and the amount of success which attends it will primarily depend on the degree of dilatation of the cervix. This again is dependent on the length of labour and the type of uterine contractions. The question can best be answered by outlining the principles which have guided me during the last three years:—

The history and abdominal diagnosis are immediately acted upon and Cæsarean section performed—

1 In all primigravidae not in labour irrespective of the duration of pregnancy

2 In the majority of multigravidae not in labour

3 In nearly all patients in whom (a) The present bleeding has been the *first* one, (b) The pregnancy is near term or the bleeding has coincided with the onset of labour, (c) The loss is a heavy one. For when the hæmorrhage has shown these three characteristics it is strongly in favour of the placenta being central

Vaginal examination may be made and vaginal treatment frequently but not always carried out—

1 In primigravidae in whom there is evidence from the duration of labour and the type of pains that dilatation is well advanced

2 In multigravidae in whom good pains have been present for a few hours or more

3 In all patients in whom, though the history is suggestive, so much of the head has passed the brim as to make the existence of a really low insertion of the placenta appear improbable

In short, the above groups include those less commonly met patients in whom bleeding first occurs as a result of stretching of the lower segment in labour, i.e., the insertion of the placenta is of the lateral or high lateral type. Spontaneous or artificial rupture of the membranes will generally prevent any further loss

Vaginal diagnosis is undertaken only by the one who is going to treat the case. It is not made unless an anæsthetist is present, nor until everything is in readiness to proceed to either Cæsarean section or that form of vaginal treatment which will appear most appropriate. When blood transfusion is indicated I like this to be in progress during the whole intervention, whatever route is chosen. If the continuous drip apparatus is used, the speed with which it is given can be altered according to circumstances

The above is a very imperfect attempt to translate into writing an approach which is purely clinical and individual. Of the placenta prævia patients treated personally during the last three years, seven out of every ten have been delivered abdominally

Where to Operate.—This may seem a trivial matter, but in the most severely ill patients it may make all the difference. Such

women are quite unfit to be translated from the bed to the operating table. On one occasion I have performed the operation on the ordinary lying-in bed; on another in the bed to which the patient was admitted in the labour ward.

The Anæsthetic.—Spinal anæsthesia is favoured by many. The special advantages it has in these cases have already been pointed out. Its use should be restricted to those in whom anæmia is slight or only of a moderate degree. Hendry and Baird use spinal anæsthesia, but admit that they have experienced moments of "grave anxiety". Audébert and Estienny encountered one severe but temporary collapse among three patients delivered under spinal anæsthesia. Echevarria, Paucot and Reeb, Binder, Laffont and Fulconis, Rismondo, Preissecker, and a large number of others, have been well satisfied with this method. The only death in Echevarria's twenty-three patients was due to uterine atony and followed ether anæsthesia.

I find uterine retraction is just as good when using local anæsthesia. None of its drawbacks are apparent in these patients. The child is usually small, the presenting part not engaged, and delivery is easy.

OTHER QUESTIONS

The Fœtus is Doubtfully Viable.—Placenta prævia is a grave maternal danger. The earlier the pregnancy the more rigid the cervix. If the loss has been at all severe Cæsarean section should not be delayed.

Cæsarean section results in the Göttingen Frauenklinik have recently been published by Martius and Bickenbach. The former writes: "Among the 64 cases of placenta prævia (and premature separation of the normally implanted placenta) we have had no death. On the other hand, of 29 patients with placenta prævia treated by bipolar (two-finger) version, 6 mothers and 12 infants have perished. The majority of these deaths occurred in women whom we would have delivered by Cæsarean section had the infants been viable. In the future, therefore, we shall in certain circumstances subject to the operation also those patients in whom the fœtus is already dead or unlikely to survive; that is, we shall operate solely in the interests of the mother."

The Fœtus is Dead.—The same reasoning prevails. Death is due either to the poor condition of the mother or to the fact that a large area of placenta has been separated. I have only once performed

Cæsarean section in the presence of a dead fœtus, but this is only, because such cases are met with comparatively rarely. I have no qualms of conscience in this matter. Actually I do not perform Cæsarean section in order to save fœtal life. It is only a happy coincidence that this line of treatment does so often lead to such a result.

The Exsanguinated Woman.—Blood transfusion may frequently convert what at first seemed a hazardous procedure into a perfectly safe Cæsarean section. Yet care is necessary before coming to a decision in these cases. My present impression is that the *primigravida* will always be better served by abdominal section *without vaginal examination*. The *multigravida* should be considered individually, if, when blood has been given, digital examination shows the condition of the os to be favourable, that a gentle vaginal manœuvre can be easily and speedily executed, and that delivery is not likely to be long delayed, then this course may possibly be better than abdominal delivery. I believe it will prove extremely hard to arrive consistently at the correct decision in these cases.

EXPECTANT TREATMENT

There is still the management of another type of case. The patient presents herself after a very slight 'show'. The pregnancy may be anywhere between the twenty-eighth and thirty-fifth weeks. Such a patient is admitted and confined strictly to bed. Vaginal and cervical causes for the 'show' can be excluded with the speculum. When the cervix will easily admit one finger (and this is commonly the case, especially in *multigravida*) the diagnosis may be immediately settled. In all others the assumption is made that the case is one of placenta prævia and future events will generally justify it. In the judgement of many an expectant attitude is often considered permissible in this type of patient. This question is likely, however, to remain a matter for individual decision. I have known two patients under expectant treatment who eventually died. I have searched the records of the hospital and found further instances of this calamity. There are still others who have come almost to the point of death, and, in addition, have lost their infants. While the first hæmorrhage is often slight, and, if occurring many weeks before term, has rarely proved fatal, there is not the least guarantee as to

what will be the nature of the second. Finally, from the point of view of infection, I believe it is desirable to empty the uterus as early as possible after the first digital examination, if this has been thought to be necessary.

For these reasons, only in the most exceptional circumstances can I consent to treat any patient of my own expectantly.

SURGICAL, PHYSIOLOGICAL, AND PATHOLOGICAL JUSTIFICATION FOR CÆSAREAN SECTION

1. **Prevention of Post-partum Hæmorrhage.**—In all cases in which delivery through the natural passages is permitted, two things must occur:—

- a. Stretching and complete development of the lower segment.
- b. Further separation of the placenta from the uterine wall.

The former occurrence is a possible factor in the production of lower segment atony; both together would seem to offer the ideal conditions for a massive and even fatal post-partum hæmorrhage. The comparative rarity of this event in patients delivered abdominally is mainly due, I believe, to the fact that Cæsarean section anticipates these changes. It can easily be shown that the average death-rate in placenta prævia from this single factor, post-partum hæmorrhage following vaginal delivery, is much higher than the mortality of Cæsarean section for this condition in some of the leading clinics of the world.

2. **Immediate Control of the Uterus.**—Failure of retraction or abnormal bleeding can be countered by massage, and rapid, efficient, and aseptic packing of the uterine cavity, or even by hysterectomy.

3. **Prevention of Injury to Soft Parts.**—Deep and even fatal cervical lacerations have been known to follow vaginal delivery. It is a mistake to believe that these have always arisen only as a result of premature or injudicious extraction of the infant.

4. **Diminished Risk of Uterine Infection.**—The uterine cavity and placental site are approached through the sterile abdominal incision. This is, perhaps, the supreme advantage of Cæsarean section.

But, it might be argued, may we not simply be substituting the danger of peritonitis for the risk of uterine sepsis. I do not think so. All my experience goes to convince me that the uterine cavity is much more susceptible to infection carried up from the vulva and

vagina than is the peritoneum to infective material spilled from the uterus

WHY THE LOWER SEGMENT OPERATION?

Additional Protection against Peritonitis.—Every patient with placenta prævia not operated upon directly following the first hæmorrhage must be regarded as 'potentially infected'. The first bleeding is often no more than a 'show', it has, however, certain consequences. An area of placenta is separated. Small clots may remain just within the cervix, and these can frequently be found on examining the placenta or lower segment at the time of operation. There is thus a nidus for the growth of infection. The cervical plug of mucus, if not wholly washed away, is at least disturbed. The presence of blood in the vagina alters the reaction of its secretion. Thus between the vulva and the placental site itself the barriers against infection, if not entirely broken down, are seriously weakened (Bar and Brindeau Essen-Møller). If, up till now, the danger is more theoretical than real, it assumes a fresh significance once vaginal examinations are made. From this moment it will always prove wiser to regard these patients as infected, especially if the vaginal interference has taken place before admission.

I quote a case which is both illustrative and instructive —

June 9 —Patient admitted to hospital because of moderate bleeding. Os admitted one finger and marginal placenta felt under general anæsthesia.

June 12 —Condition good. Classical Cæsarean section followed by blood transfusion. There had been continuous slight bleeding following the examination.

Patient died later of low grade peritonitis.

Cæsarean section should have been performed on the day of admission, so that organisms carried in by the vaginal examination would not have had time to proliferate. (Hendry and Baird.)

But it must be noted that in the vast majority of instances infection can only be *presumed*. Not one of more than 150 patients with whom I have been associated has had fever on admission. There were only 4 in whom the temperature was raised and infection clearly established before delivery, but in all of these labour was greatly prolonged. Yet there is little doubt that it is already there though latent in many others. The early appearance of uterine infection in the puerperium after all forms of treatment, and even



Fig 55—Uterus from patient dying from profuse hæmorrhage two hours after section for central placenta prævia. On the left lateral wall of the lower segment was a large plaque of partially organized blood-clot. The circular mass, the size of a walnut, could be shelled out of the wall by light dissection. The incisions in the uterovesical peritoneum and uterus have been marked with match-sticks. The exact origin of the fatal hæmorrhage could not be discovered. The cervical plug of mucus was found adherent to the anterior wall but wholly detached from the posterior wall of the cervix.

The specimen also illustrates a well performed true lower segment operation in a patient at term who was not in labour.

occasionally in the absence of vaginal examination or manipulation, is sufficient proof of this

Management of the Third Stage.—The placenta and placental site are directly under the eye. If hæmorrhage is occurring this is immediately noticed, especially if the lower uterine flap is drawn aside. Manual removal can be carried out or normal extrusion awaited according to circumstances. The placental bed is open to inspection, and packing, if deemed necessary, can be disposed in the best manner possible. According to DeLee, oozing from sinuses in the placental bed may be controlled by underrunning these with a needle and suture.

Throughout the whole of the third stage, whether the placenta is extruded naturally or removed with the hand the corpus uteri remains in, or can be aroused to, a state of firm retraction. This, in 'taking up' the lower segment, is certainly the major factor in the efficient control of hæmorrhage from this region of the uterus. When the classical operation is chosen this possibility is not present. Owing to the manipulations of hand and wrist through the corporeal incision complete retraction cannot occur *until* the placenta has been extracted, and if there is delay or difficulty in carrying out this step severe and uncontrollable hæmorrhage will persist until the hand and placenta are withdrawn.

Shock—Gentle and slow extraction of the infant through a lower segment incision, especially if local anæsthesia is used, causes less disturbance to the majority of anæmic women than any other form of delivery.

A Sounder Scar.—The scar is in the lower segment, placenta prævia is unlikely to occur again, and safe vaginal delivery may be expected in future labours. Hendry and Baird, however, have followed up their series of cases (*classical* sections), and among a considerable number of subsequent pregnancies and labours have found no instance in which the uterine scar gave rise to anxiety.

OBJECTIONS TO THE LOWER SEGMENT OPERATION

The following objections have been raised against its use —

1 *Owing to the fact that in many of these patients the pregnancy is not at term the lower segment will not be 'well formed' and technical difficulties will be encountered.* When much prematurity exists, the vertical extent of that part of the anterior wall covered by mobile

peritoneum is certainly reduced in length and lies more deeply in the pelvis. This region is also narrower, and does not appear to be 'spread' in the same way as it is nearer term. It is quite wrong, however, to imagine that the operation should therefore prove more difficult, be less perfect, or fail to realize all the advantages that have

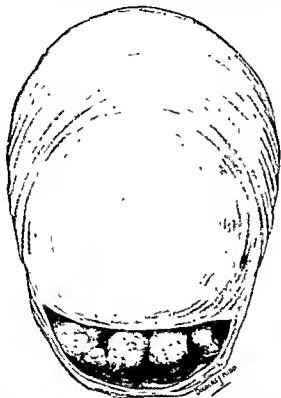


Fig. 86.—Placenta and membranes from a patient with placenta prævia delivered by transverse lower segment operation. The placenta was mainly on the posterior wall but covered the internal os and spread for a short distance on to the anterior wall.

been claimed for it. Unless there is any contra-indication, the bladder should still be displaced downwards. This is done, not so much with the aim of placing the incision primarily in a retrovesical region, but in order that, once the infant has been delivered, the wound closed, and the uterus has retracted, the incision will come to lie in this position when the uterovesical suture takes up the peritoneal 'slack' and at the same time raises the bladder to a higher level. Thus the essential features of the operation are retained.

The above argument, however, is perfectly valid when the vertical incision is used. From a careful study of the parts I cannot believe that this type of incision is ever confined wholly to the lower segment in such circumstances, or, indeed, even in the majority of patients operated on before labour has begun. Such an impression is also shared by Sussmann. "I find like several others that our cervical sections are not always cervical but are often cervico-corporeal (and it would be better to name them so) when the operation is done at the beginning of labour, for eclampsia, or for placenta prævia before the lower segment is stretched."

2 *The front of the lower segment may be unusually vascular.* In my own series of operations I have continually kept this question in view. Abnormal vascular arrangements may present themselves in three forms—as large veins immediately beneath the uterovesical peritoneum and sharing its mobility, as tributaries of the lateral venous trunks emerging from the uterine wall some distance internal to its lateral margins, and, finally, as broad, thin-walled, and bluish sinuses within the uterine wall and shining through its superficial layers (*Fig 87*). One or other of these peculiar distributions was found in 10 out of my 43 patients. Though their presence is not peculiar to placenta prævia, they occur much more frequently with this condition than with any other. In seven instances the placenta was mainly on the anterior wall and involved the line of the incision. In another the placenta was entered with the knife but the larger portion of it was on the posterior wall. In two instances only were gross venous abnormalities present and yet the placenta was wholly on the posterior wall of the lower segment.

There are very few references to these conditions in the literature. Vilarama has attributed severe bleeding on incising the lower segment in one patient to the presence of an exaggerated venous circulation. In a case described by Rotthaus profuse hæmorrhage resulted from pushing down the bladder. *It proved uncontrollable and his patient died* (p 172). Hendry states that he has employed the lower segment operation twice in cases of placenta prævia. He had great difficulty in controlling hæmorrhage. This might have been less, he thinks, had spinal been used instead of general anæsthesia.

3 *The incision may involve the placental site, the placenta is disturbed before the child is born, extraction may have to be hurried on account of bleeding, the child, especially if premature, may be injured.* In my experience so much of the placenta was on the

anterior wall that it became involved in the incision and manipulations in 14 instances, or about 30 per cent of the cases. In Echevarria's series the frequency was about the same. Vogt found a higher incidence, the placenta being on the front wall in approximately every other case.

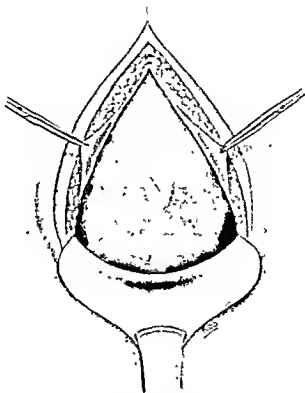


Fig. 87.—Broad, flat, thin-walled veins partly buried in the uterine muscle. These have always been met by the method of "blunt incision". The initial incision is best made through the isthmus-compressor.

The fact that the placenta may have to be disturbed or detached seems to be of little significance. Höglér even goes so far as to remove it first when its presence is likely to embarrass delivery, and has experienced no unusual hæmorrhage nor any ill results from this practice. Curiosity has prompted me to do the same on two occasions. I was surprised at the relatively small amount of bleeding.

However, such a course is rarely indicated. The presence of the placenta on the anterior wall is almost a matter of indifference and should demand no special display of anxiety or haste on the part of the surgeon. Certainly an infant may be killed by haste, but this is never necessary. The whole problem would appear to resolve itself simply into a question of technique and anaesthesia. Like Preissecker I have never seen any real reason why some should be so apprehensive of the lower segment operation for placenta praevia.

4 *If the incision falls on the placental site, the uterine wall will be more friable, the suture will tend to tear out, and imperfect union will result.* As a matter of experience it is extremely difficult, once retraction has occurred, to detect any difference in the quality of the uterine wall or its suture-holding capability.

Of the 46 instances of rupture of the scar which I have been able to collect from the literature, it must be admitted that in eight of these the first operation was either for placenta praevia or that the uterine incision in some part of its extent involved the placental site. The reader can draw his own conclusions, but to my mind the significance of this is not all that at first sight it might appear to be. For there is more than a suspicion that in several of these cases the incision was not confined wholly to the lower segment and that it was the corporeal part of the scar which subsequently ruptured. Guchteneere, himself a reporter of a case of subsequent rupture of a vertical scar, has warned against extending the incision into the corpus, 'a course to which one is not seldom compelled when the patient is operated on before the onset of labour'.

Bonnet (1934) could collect from the literature 37 instances of subsequent rupture of the lower segment scar. After omitting three of Bonnet's cases, which I believe to have been reported twice, I have now been able to bring the total up to 50. But even this would not appear to be an exhaustive list, for in 1936 Durst stated that he knew rupture to have occurred on 55 occasions. DeLee (1938) gave the number as 49.

Among the 37 patients of whom I possess full details, three died, a mortality of 8 per cent. Contrast this with the total number of deaths due to spinal anaesthesia!

5 *Femoral Thrombophlebitis*—This has arisen three times (two mild and one severe) among my 43 lower segment operations for placenta praevia. I have no comparable data for the classical

operation, but it is possible that such a high incidence (nearly 7 per cent) would not occur with this form of section. (*See also* p. 51).

COMPARATIVE RESULTS

As yet I believe it is impossible to ascribe to either the classical or the lower segment operation any definite superiority over the other. The more I have studied this question the more I have become convinced that (infected cases excepted) it is not so much the type of operation that counts as the associated and surrounding circumstances—a minimum of handling and pre-operative investigation, swift intervention, blood transfusions, intravenous infusion, careful anæsthesia, a high degree of team work, and the will to succeed. For this reason, only four sets of figures are offered, as they show what is possible of attainment in clinics which are working along the same lines.

MORTALITY OF CÆSAREAN SECTION IN PLACENTA PRÆVIA

AUTHORS	CLINIC	TYPE OF OPERATION	NO. OF CASES	MATERNAL MORTALITY PER CENT
Hendry and Baird (1937)	Glasgow Royal Maternity Hospital (2 years)	Classical	87	1.1
Daily (1934 and 1935)	Chicago Lying-in Hospital	Cervical	68*	0
Siegel (1934)	University of Maryland	Classical	101	0.99
Bill (1931)	Cleveland	Classical	104 (78 per cent treated by C.S.)	1.93

* Now 150 without a death (DeLee)

I shall in the meantime remain faithful to the lower segment operation. It is hoped, in this way, to avoid the occasional fatality from peritonitis such as Hendry and Baird have described, or the one that marred the series published by Siegel.

Shortly after the appearance of the lower segment operation, obstetricians became divided into two camps over this very question. Sellheim led the 'segmentalists', Krönig the 'corporealists'. They have their followers to the present day. The monographs by Küstner and Vogt, the papers by Rothhaus, Findley, and the numerous writings of DeLee should be consulted.

TECHNIQUE

Pre-operative Version—In my early experience with this operation for placenta prævia I was inclined to think that it might be an advantage if the breech were made to present. But external version is not entirely free from risk. The manipulations started severe bleeding in the one patient in whom this was carried out and since then I would not recommend such a course.

The Uterovesical Peritoneum.—This is incised about one inch above its reflection on to the bladder, and the upper peritoneal flap is raised by light *dissection* beyond the level to which it can be simply *elevated* from the uterine wall. The bladder is then displaced downwards.

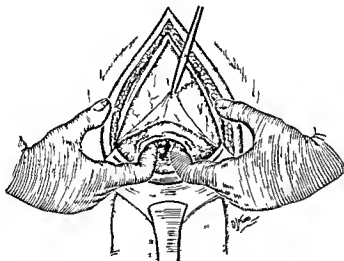


Fig 88 — Blunt incision of the uterus (Geppert and Hauser) in a case of placenta prævia. The placenta itself is not torn or cut through.

Initial Uterine Incision—This is made as low as possible. As the muscle is divided it becomes at once apparent from its appearance and degree of vascularity whether or not the placenta lies immediately beneath the line of incision.

If Placental Tissue Appears.—*The index fingers are inserted and the wound immediately extended.* It is surprising how little bleeding may sometimes result from this, I have frequently been able to stop at this stage and demonstrate to all present the maternal surface of the placenta bulging through the wound. After all there is merely a linear separation of the placenta and the wound edges immediately retract.

As in the majority of instances the greater part of the placenta is either on the anterior or posterior wall, it is better to pass the hand up the lateral aspect of the uterus. When membranes are reached these are ruptured, a foot secured, and the leg and thigh drawn into the wound (*see Plate II*). Any bleeding that has been aroused now ceases immediately. Extraction is continued slowly, the incision extending of itself to accommodate the increasing diameters of the child.

If Membranes Appear.—The incision is extended in any way the operator may choose, though I believe the blunt procedure is still preferable. Delivery is effected in whatever manner seems most convenient. The operation, indeed, need differ in little from that ordinarily employed. The use of Willett's forceps is not advised, as the scalp of the premature infant is very prone to tear.

Third Stage.—When the placenta has been interfered with before extraction of the infant it is best to remove it immediately by expression and cord traction. If this is not successful the hand is used. In all other cases normal separation is awaited.

The placenta was separated with the hand in 12 of my cases. I am now doing it much less frequently than formerly.

Uterine Packing.—It would perhaps be safer to use this in all these patients. I have employed it twice. The pack should be removed in six hours.

Oxytocic Injections.—These were used on only 12 occasions—that is, in the presence of definite indications. Their use was restricted in order to test the effect of spinal and local anæsthesia on uterine retraction. I would recommend that they should be given in every case.

The courses outlined are simple and effective. Audébert has advocated a *segmento-corporeal* incision to deal with this condition. Frigyesi has recommended temporary clamping of the broad ligaments. Rotthaus mentions *division of the uterine wall* between hæmostatic forceps. All seem to me to be unnecessary. Nevertheless, I would suggest that a patient with placenta prævia is not the one on whom an obstetrician should begin his experience of the lower segment operation; it should be reserved until he has become inured to all the ordinary difficulties which the procedure may present and preferably until the time when he has accustomed himself to perform the operation under local anæsthesia.



PLATE II —Lower segment Caesarean section in a case of placenta previa.
The leg and thigh drawn into the wound.

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CHAPTER IX

DIFFICULTIES, DANGERS, AND MISHAPS

WITHOUT question the classical operation is the simplest and speediest way of performing Cæsarean section. There is almost no limit to which the uterine incision may be safely extended, at no time are important structures placed in the slightest danger, and it is practically unknown for the extraction of the infant to present any special difficulty.

None of this can be said of the lower operation. While not actually a *dangerous* operation it certainly possesses considerable potentialities for evil.

ACCESS TO THE UTEROVESICAL POUCH

Occasionally this is a little difficult, especially when the head is overriding the symphysis, lordosis is present, and the abdominal muscles are incompletely relaxed. Elevation of the patient's head and thighs, a slight degree of Trendelenburg, and the pressure of the assistant's right hand, will give all the help that is required to expose the retropubic space.

When performing the operation after a previous classical section, I have frequently found the front of the uterus bound to the abdominal wall by dense avascular adhesions. In such cases I have always reached the lower segment by simple blunt dissection with the fingers. To all intents the operation is then an extraperitoneal one.

INJURIES TO THE BLADDER

There is a possibility of this organ being injured in the following ways :—

1. **In Opening the Peritoneal Cavity.**—A catheter should be passed immediately before the operation. Just before and during its withdrawal the organ is completely emptied of urine *and air* by firm suprapubic pressure. After a long trial of labour, however, the bladder, in the process of being drawn up, may become nipped between the head and the upper border of the symphysis pubis.

The nurse reports successful catheterization and the withdrawal of a small amount of urine yet at operation the organ may be found greatly ballooned and extending high into the abdomen. Obviously only the lower compartment has been drained. Frank drew attention to this error many years ago (*Fig 89*). There are other times when the bladder though empty may be accidentally opened in the lower third of the wound even before the peritoneum is incised (*see p 44*).

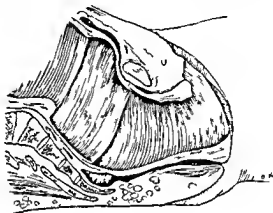


Fig 89 — T o compartment bladder

2 During Downward Displacement—In late obstructed labour the base of the bladder shares to some extent in the œdematous and friable condition of the cervix and it is quite conceivable that careless or rough handling at this stage may cause a tear in its wall. The finger tips should be protected with a swab and the bladder be drawn *not pushed* down (*see Fig 44 p 88*).

3 In Opening the Uterus—Undoubtedly this has sometimes occurred when the vertical incision has been employed.

4 During Extraction of the Infant—Injury to the bladder is likely if extension of the vertical incision should occur at this moment. This risk is not entirely absent even with the transverse incision. In extracting a very large infant in a patient in whom labour was obstructed I once split the lower uterine flap right into the vagina. Had not the bladder been previously displaced it must have shared in this laceration.

But a case is known to Pierce which must surely be unique.

The incision into the uterus was made through the bladder and the accident not discovered until the fœtus had been delivered. The

uterus was closed, then the anterior and the posterior walls of the bladder. The woman made an **uneventful** recovery and no bladder complications followed."

5. As a **Late Result of the Operation**.—The bladder has been involved in the subsequent rupture of a lower segment scar. Instances are mentioned by Jäger, Loch, and Strauss.

Von Ammon (1930) could find among 887 Cæsarean sections only 6 instances of injury to the bladder. Reeb (1935) reported 4 occurring in 415 cases. The laceration commonly escapes recognition at the time of operation; the result is a cervicovesical or vesicovaginal fistula. I know of only one such case, but here the operative factor could be definitely excluded; the woman had been in labour some days and the lesion clearly resulted from prolonged pressure of the presenting head.

Needless to say any injury to the bladder should be carefully repaired, and an indwelling catheter inserted. It will also be wise to drain the peritoneal cavity.

HEMORRHAGE DUE TO DEXTRO-ROTATION OF THE UTERUS

Present to a slight degree in all cases, torsion may be so pronounced in a few as to give rise to serious complications if allowed to pass unheeded. Its most obvious result is to throw the left round ligament into greater prominence and even so far towards the midline that it may present in the abdominal incision (*Fig. 90*). Of more importance, however, is the associated displacement of the lateral border of the uterus and the contents of the broad ligament; the left uterine artery comes to lie on a more anterior plane, and the more mobile venous plexuses are rotated inwards and appear to lie on the anterior surface of the lower segment. These changes have a fourfold significance: (1) The presence of venous trunks beneath the pre-segmental peritoneum and its uterovesical reflection may at first sight make the operation appear impossible. (2) The longitudinal incision will fall vertically in relation to the mother's body and yet not occupy a median position in the uterus. Its upper end at least will encroach upon the highly vascular lateral border of the lower segment, and if prolonged would extend towards the left uterine cornu (Bud). (3) When the transverse incision is used, some two-thirds of it will fall to the left of the middle of the uterus, and the uterine artery and

large veins of this side will be in danger of division (4). The act of pushing down the bladder is carried out too far laterally and once again the vessels are in danger—this time from the fingers. Rismondo is inclined to attribute the fatal hæmorrhage encountered by Rotthaus to such an occurrence. Rismondo, Bud, Fuchs, and many others

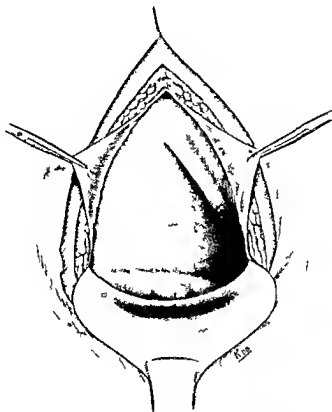


Fig 90—Marked dextro rotation. The large veins which presented almost in the midline are omitted (From a film)

have therefore stressed the importance of correcting any existing degree of dextro-rotation. This is best done by pressure directed forwards and inwards with the hand in the right flank.

HÆMORRHAGE FROM THE UTERINE WOUND

From the Incision Itself—Burger has recorded a case of fatal hæmorrhage occurring from the edges of the uterine incision. But such an occurrence must be extremely rare. Even before adopting

any special measures to control it I had rarely seen hæmorrhage so severe as to endanger the patient. Such has also been the experience of Munro Kerr and Hendry. Only occasionally has bleeding been sufficiently free to embarrass the subsequent manipulations or call for a little haste on the part of the operator. Nevertheless methods have been devised which will render the majority of operations almost bloodless.

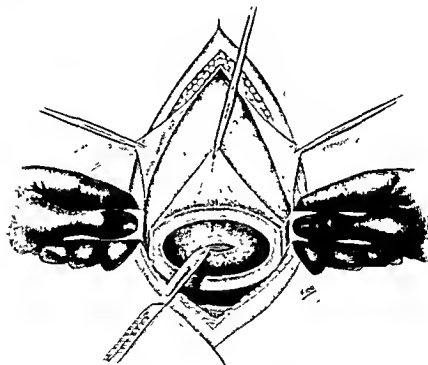


Fig. 91.—Bonney's ischio-compressor in use.

Bonney's Uterine Compressor and Willett's Forceps.—The hæmo-static effect can be readily understood from the accompanying illustration (Fig. 91). The scalp is exposed bloodlessly through a small incision, the Willett forceps is immediately applied, and the compressor instrument removed. The claims which Bonney has advanced for the method have been fully substantiated by Fuchs and his colleagues, who have used it in a very large number of operations. One suggestion is offered. Its use may tend to make the surgeon place the original incision too high when the head is mobile unless care is taken to press the instrument upwards and

backwards against the vertex rather than directly against the side of the head

Butler, using a modified compressor, has the assistant pass his right hand down behind the uterus, the head is pushed forwards against the instrument and greater pressure is thus obtained

Special Hæmostatic Forceps—These have been of service in the hands of Harvey Evers, Green-Armytage, and others (*Fig 92*) They can be used with either the vertical or transverse incision, and are applied in series to the edges of the wound as this is progressively enlarged

Special Hæmostatic Clamps—The use of these has been illustrated by DeLee and also by Pierce, as shown in *Figs 93, 94*

'*Blunt Incision*' of the Uterus—This has been advocated especially by Geppert and Hauser The small initial incision is spread with the index fingers Irregular tearing does not occur when this is carried out in a transverse direction Whenever speed and bloodlessness are urgently demanded I regard the method as ideal (*see p 161*)

A sudden spout of blood as the incision is being extended laterally with the scissors does not always have its origin in a vessel of the uterine wall Cases are known in which the umbilical cord has been accidentally divided (Pierce)

Hæmorrhage from the Lateral Angles of the Incision—The incision may be extended too far laterally and either the uterine artery or some large venous trunk be opened Green-Armytage forceps can be temporarily applied and the delivery proceeded with The accident, however, is more likely to arise through sudden extension of the wound during extraction of a large head, and will usually not be noticed until delivery is complete Meissner has recorded a case where the tear extended through the uterine artery into the parametrium, the bleeding proved fatal (von Ammon) Mikulicz-Radecki



Fig 92—Green Armytage hæmostatic forceps

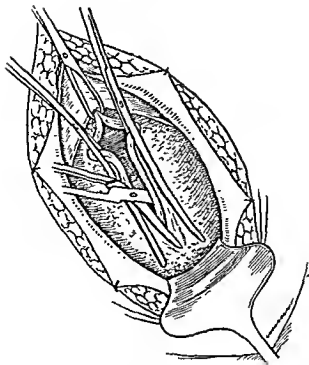


Fig. 93—Hæmostatic clamps as applied by DeLee.
(Redrawn from DeLee)

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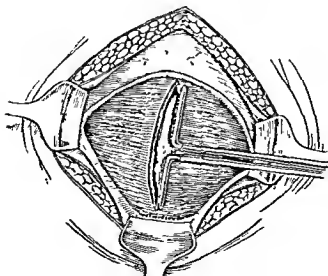


Fig. 94—Hæmostatic clamps (Robowits's) used in making the
uterine incision. (Redrawn from Pierce.)

reports division of the uterine artery necessitating hysterectomy I have on one occasion divided the uterine artery, but as both ends were easily visible they were clamped and ligated

The possibility of these accidents arising is greatly lessened if a convex incision is employed The lateral borders are thus avoided during opening of the uterus, and any unexpected extension of the incision will tend to occur in an upward direction

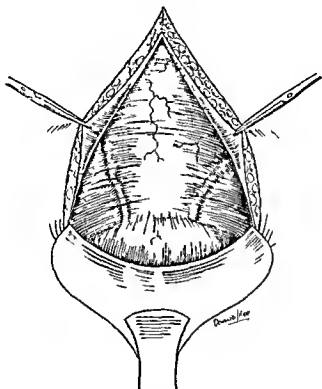


Fig 95—Two abnormal veins treated by double ligation

Bleeding from Abnormal Vessels.—The only arterial irregularity which I have encountered was a branch of the left uterine artery coursing inwards and upwards at the level of the uterovesical reflection for at least two and half inches before entering the uterine muscle It was as thick as the radial artery at the wrist, and preliminary ligation was carried out

Abnormal venous arrangements are more often seen The commoner types are illustrated (*Figs 95 98*) One variety of which I have seen a few examples deserves special mention If, after

pushing the bladder down, the bladder bed is carefully inspected, one or more large veins may sometimes be seen running out towards the parametrium. They are exposed to the risk of rupture during displacement of the bladder, or they may be torn from their union with a larger vessel.

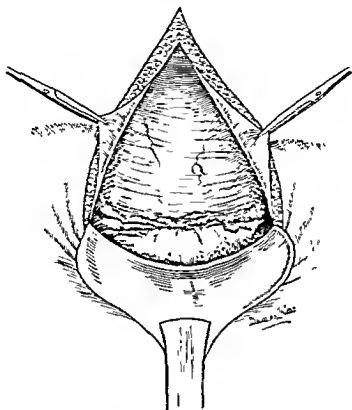


FIG. 46.—Varieties of the utero-vesical fold. The peritoneum is opened just above the veins which are safely displaced with the bladder and the lower flap of the peritoneum.

The case reported by Rotthaus is instructive. His patient was 41 years of age and section was done for placenta prævia. As the bladder was being pushed down profuse bleeding arose from the retrovesical space. Packing was employed and the child delivered. Attempts to discover the source of bleeding were unavailing, and the woman died an hour later despite blood transfusion.

Bleeding from the Wound Edges after Delivery.—Owing to the control exerted over the upper edge of the incision by the retracting corpus, bleeding points in this site are rarely seen. Not

uncommonly, however, one or more freely oozing vessels will be found in the loose edge of the flaccid lower flap. They seldom require more than temporary clamping and reliable hæmostasis is usually secured by the closing suture alone.

Laceration of the Lower Uterine Flap—This occurs now and again when the patient is operated on late in labour the head

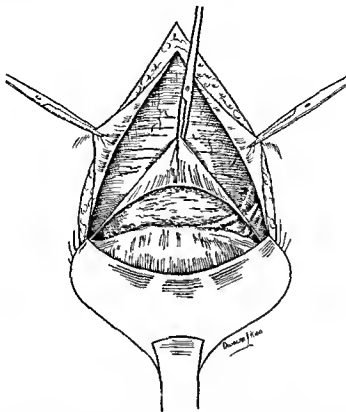


Fig. 97.—Another variety of veins which will become inflamed when the incision is extended to the left. Preliminary ligatures the treatment or they may escape laceration if the incision is extended with the fingers.

tightly wedged the lower segment and cervix thin and friable and the extraction difficult. The tear should be carefully closed with a suture beginning in the lower angle.

Hæmatoma of the Uterine Wall—As the needle is being passed near the angles of the wound a vessel is sometimes pricked and an intramuscular hæmatoma results which may swell to the size of a hen's egg. According to Bonnet it may be a potential source of weakness in the scar. It is however best left undisturbed as the

blood is not a single collection but is diffused among the muscular fibres of the uterine wall.

Hæmatoma of the Broad Ligament.—This may arise from injury to vessels in the angle of the incision and probably occurs more often than is suspected. It arouses pain and tenderness in one or other

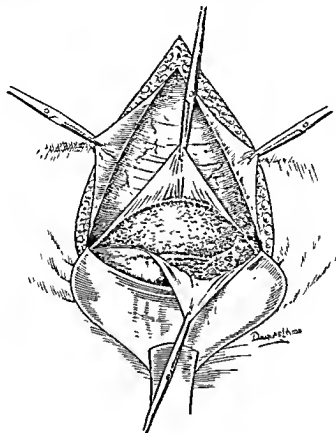


Fig. 98.—A retrovesical vein.

iliac fossa, absorbs slowly, and is frequently the cause of a low-grade pyrexia which may persist for many days.

Retrovesical Hæmatoma.—This results from injury to a retrovesical vein or from a failure to secure complete hæmostasis with the second uterine suture. All oozing points should be controlled by mattress sutures, otherwise it may occasionally be necessary to reopen the uterovesical peritoneum to deal with a hæmatoma which is obviously forming behind it towards the end of the operation.

SUTURE OF THE UPPER EDGE OF THE WOUND TO THE POSTERIOR WALL OF THE UTERUS

The fact that I have seen this happen four times and have learned from colleagues of its occurrence on three further occasions shows that the error is not so impossible as it might appear. After delivery of the infant and placenta, the cervical flap sinks deeply into the pelvis and its edge may lie hidden behind the bladder and blood-clot. The posterior wall in many cases herniates forwards into the wound like the spur of a colostomy, and to this ridge the upper edge of the incision is unwittingly sutured. Recovery of the lower flap is always certain and easy if a traction suture is inserted at the time of making the initial incision into the uterus. So far as I know Solomons is the only one who has drawn attention to this accident.

The easy recovery of the lower flap has another importance. Free hæmorrhage following delivery of the child is not always due to partial separation of the placenta. If the lower edge of the uterine wound be immediately inspected, profuse bleeding may sometimes be seen issuing from a large wide mouthed vein which will usually be found near one of the lateral angles of the wound.

CONstriction RING OR HOUR-GLASS CONTRACTION OF THE UTERUS

The above terms are purposely chosen, for their sense is purely descriptive. Neither of them commits us to a final decision as to the exact site, nor to a hard-and-fast belief in any one of the numerous theories which have been put forward to explain the origin, of the rings. There have been considerable opportunities for studying this condition through an abdominal incision, and the following brief remarks are based solely on observation of the living anatomy made at the time of operation (*Figs 99-101*).

The Site—The ring may form anywhere between the level of the internal os (one case) and the midpoint of the uterus, or even higher (one case). They have been found with about equal frequency lying either around the neck of the fœtus or at various points above the level of its shoulders. Though such rings are sometimes thought to be confined to the uterus in labour, this is not invariably the case. On one occasion an extraordinarily well developed ring has been seen in a primigravida operated on during the last week of pregnancy.



FIG. 99.—Constriction ring. Primigravida, large post-mature infant, obstructed labour. Position occipito-posterior. Slight secondary rise between ring and pubes caused by bladder which held 3 oz. of urine. Lower segment distended with putrescent liquor. (Photographed immediately before Cæsarean section. Case No. 217 p. 202.)



FIG. 100.—Not a constriction ring but a uterine fibroid. It became apparent in the abdomen only towards the end of the first stage. During the twenty minutes it was watched before natural delivery occurred it rose a further few inches to its present level. A fibroid in such a position would probably form a contra-indication to the lower segment operation.

Nine out of every ten arise at the junction of upper and lower segments if the following observations can be accepted as evidence of this fact —

1 The ring, if well marked at the time of opening the abdomen, persists as a constricting band paler than the rest of the uterus throughout the whole operation, and is still in evidence when the parietal peritoneum is being closed

This fact allows two further observations to be made, as follows —

2 The uterine wall below the level of the ring remains quite flaccid, is much thinner than that part above the ring, and does not share in the firm retraction of the latter part of the uterus

3 After delivery of the child and placenta the peritoneum on the front of the uterus will be found to be mobile up to the level of the constriction. The uterine incision after closure will also be seen to lie very low in the pelvis and have above it in many instances a considerable length of lower segment

Exactly what proportion of the wall of the lower compartment is formed of true cervical tissue is difficult to determine with accuracy. It must be considerable in many instances, for the incision will frequently be found at the end of the operation to be within one inch of the external os

The Condition of the Uterus Below the Constriction Ring—The anterior wall of the lower segment generally assumes one of two forms. It is either tightly applied to the portion of the fœtus in advance of the ring or is greatly ballooned, distended with liquor or even with liquor and gas, and tensely fluctuant. Whichever form arises seems to be decided by the amount of liquor retained, that is, by the degree to which the head had become applied to the cervix and wedged in the brim at the moment when the membranes ruptured

The Uterus above the Ring—This has always been found tightly clasping the fœtus, and it would appear that all the remaining liquor has been forced into the lower segment

The level of the uterovesical reflection of peritoneum even when the bladder is completely empty, will frequently be found in these cases a full hand's breadth above the symphysis pubis

In almost all cases, and particularly where the segment is 'ballooned', the uterine wall is exceedingly thin, in many rupture is certainly imminent

One patient was operated on after more than forty hours in labour. The pulse was rapid, the temperature 101.2° F., the head surmounted by a huge caput and tightly wedged in the upper pelvis, and the external appearances almost exactly those of the patient photographed (Fig. 101). The vaginal secretion was odourless. The operation was performed under spinal anæsthesia. The contents of the lower segment were under such tension that at the first prick of the scalpel purulent liquor and foul-smelling gas were released with sufficient force to drench the mask and spectacles of the operator. Enlargement of the puncture was unnecessary; a few moments later a pain occurred and the lower segment (or cervix) split regularly from side to side.



Fig. 101.—Constriction ring. Elderly multigravida with flat pelvis; obstructed labour, with threatening rupture of the uterus. Presentation: occipitalis pubica ("high antero-posterior arrest"). Cervix fully dilated one hour. The ring rose from a hand's-breadth below the umbilicus to the position shown in less than 30 minutes. Manual dilatation of ring required in order to secure the placenta. (Photographed immediately before Cæsarean section—Case No. 6, p. 176.)

Influence of the Ring on Delivery.—*The infant*: For certain types of ring Audébert has advised a vertical segmento-corporeal incision which divides the ring. This is quite unnecessary, and I am pleased to see that such a view obtains the support of Gilliatt. Some delay is experienced with the delivery of the shoulders if the ring is around the neck, but this is of little importance; steady traction on the head soon overcomes the resistance. *The placenta*: On several occasions, however, when the ring has strongly persisted after delivery of the infant I have had to pass the hand within the upper flap of the lower segment and dilate the orifice of the upper segment in order to extract the placenta.

DELIVERY OF THE HEAD

When the Head is Mobile or can be Easily Disengaged from the Brim before Opening the Uterus.—With Bailey's 'trap-door' incision no difficulty will ever be experienced. I make a much shorter incision than this and impart to it only a slight convexity,

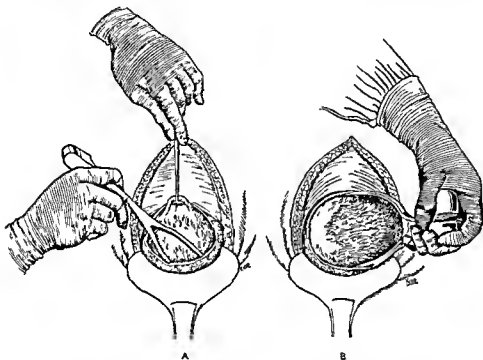


Fig. 102.—A Mobile head lying transversely. The face is not turned to the front. Applying the posterior blade of the small 'outlet' forceps. B Delivery almost complete.

preferring to take advantage of the elasticity of the wound edges in extracting the head. This is delivered then in one of three ways—

1 Gentle traction with the scalp forceps while extending the incision perhaps an extra half-inch at each end.

2 Scalp forceps, the insertion of two or three fingers between the head and the lower edge of the incision, and fundal pressure. Fundal pressure is much more effective if the liquor is allowed to escape before it is applied. If the incision has had to be rather limited, the hand, owing to the space it occupies, is often as much a hindrance as a help.

3. The simplest and neatest method is to apply a pair of small obstetric forceps while the head is drawn into the wound and steadied with the scalp forceps (*Fig. 102*). Absolute control is thus obtained over the exit of the head. This hardly differs from the technique practised by Küstner many years ago in his extraperitoneal operation (*Fig. 103*).

But countless other methods have been recommended, some of which are as follows:—

a. With a finger in the mouth the face is turned into the wound, two fingers of each hand are passed along the sides of the head, and the vertex is delivered over the lower edge of the wound by flexion.

b. Expression of the head by pressure directed forwards and inwards from the flanks.

c. One blade of the obstetric forceps. If used as a lever to prise the head from the pelvis I regard it as a dangerous method.

d. Version and extraction. This is applicable with safety only when the necessary conditions are fulfilled—smallish child, intact membranes, labour not advanced, etc. Cronheim has shown that some degree of asphyxia is very common, and that puerperal morbidity is greater when this course is adopted. (*See Fig. 107 and legend.*)

e. Miniature obstetric forceps, straight and curved, have been devised (*Fig. 104*).

f. The use of a vectis such as that constructed by Torpin. A finger of the left hand is inserted into the infant's mouth and its face pulled up to the opening. The blade of the instrument is passed round the head, which is gently lifted out of the uterine cavity (*Fig. 105*).

When the Head is Wedged in the Pelvis.—It is difficult to convey with precision the difficulties that can be met in these cases; they must be experienced. In at least one in ten the extraction can prove very trying. I have used the hand and the forceps with about equal frequency. In these patients the capacity of the pelvis is usually reduced and the hand can be inserted only at the risk of producing considerable compression of the head. On the whole the

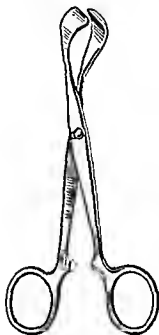


Fig. 103 — Küstner's scalp forceps (1915) for drawing the head into the wound and steadying it during application of the forceps in the extraperitoneal operation.

forceps is preferable. On all but one occasion when I failed entirely, cephalic application of the blades was easy once the face had been rotated at least part-way towards the front (*Fig 106*)

Butler gained the impression from a single experience that the head is probably most easily disimpacted by using the right hand passed behind the uterus into the pelvis before beginning the uterine part of the operation

Undoubtedly some operators have occasionally solved their problems by getting the assistant to push the head out of the pelvis with the fingers in the rectum or vagina

According to Doerfler all these difficulties will vanish if the uterus is even-trated

In the really difficult case there is a great temptation to resort to version. This should never be done, as an enormous strain is thrown on the child's spine. Pierce records two instances in which the child's neck was broken by this manœuvre

TRANSVERSE PRESENTATION

The child should always be brought into the longitudinal lie before opening the uterus and rupturing the membranes



Fig 105—Torpus sivectis

which such cases have been mentioned in the literature the writers have been content to say that "the extraction of the infant was difficult"

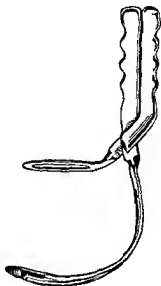


Fig 104—Acosta Sison's forceps for the mobile head. The face is not turned to the front. The concave blade is slipped behind the posterior parietal bone and the short blade applied to the anterior one. It is the most practical to be used in cases of placenta prævia where the head is high

If this is not done the liquor escapes with a rush, the back falls into the wound, the uterus contracts down firmly, and the greatest difficulty may be experienced in encircling the trunk with the hand and securing a foot from the fundus. I have never performed Cæsarean section for neglected or impacted shoulder presentation, and am unaware of the special problems that may arise. On the few occasions on which such cases have been mentioned in the literature the writers have been content to say that "the extraction of the infant was difficult"

INJURIES TO THE INFANT

The following have been seen or personally inflicted: minor scalp wounds, division of the pinna of the ear, complete section of the upper eyelid—all occurring while opening the uterus; and fracture of the humerus in hooking out an arm during delivery.

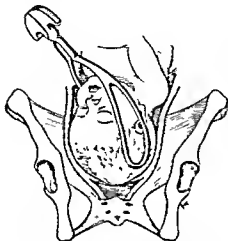


Fig. 106—Method of application of forceps to the head wedged deeply in the pelvis. The face need be only part-way rotated to the front. This method was most frequently employed in those patients in whom labour was obstructed and the occiput directed posteriorly.

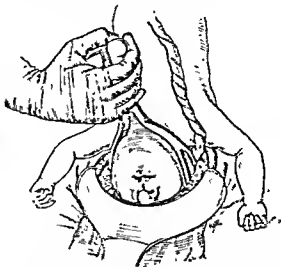


Fig. 107—The best way to bring the after-coming head, the delivery is under absolute control and the risk of splitting the lower flap by sudden escape of the head is greatly reduced.

Such accidents are really avoidable. A clear field should be maintained, and this is where the isthmocompressor is of use. The deeper fibres of the uterine muscle may be separated with the handle of the knife, or the uterine wall can be raised with special forceps from the scalp while the initial incision is being made.

Intracranial injuries, according to Sewall, are found more frequently following the lower segment than the classical operation. Richter states that a foetal mortality of almost 1 per cent results from this or other difficulties in delivery of the infant. It is not easy to decide, however, the exact part which the surgeon's manipulations play in these fatalities. I have known three infants succumb to intracranial hæmorrhage. In each case labour had been greatly prolonged and extreme moulding and large caputs were present. In one attempts had been made to deliver with forceps before admission;

the extraction of the head was easy. In the other two the delivery was unusually trying. Such occasional accidents, however, are no argument against the operation. The patient in whom the delivery is likely to prove most difficult is the very one who will derive the greatest measure of safety from an incision placed in the lower segment.

AIR EMBOLISM

Kraul's case —

Cervical Cæsarean section for contracted pelvis. Horizontal position of the patient. The placenta was on the posterior wall of the fundus. Good uterine retraction ensued after delivery, but on completion of the uterine suture the fundus was gently compressed and some blood expelled through the vagina. As the uterovesical peritoneum was being closed the patient suddenly became deeply cyanosed, the pulse almost imperceptible, and breathing ceased. A minute later the pupils became widely dilated and the heart stopped beating.

P M —The right side of the heart was distended and the right auricle especially ballooned. Opened under water these chambers released 150 c.c. of air.

Deucher's case —

Cæsarean section for contracted pelvis and occipito posterior position after twenty hours in labour. The placenta was situated on the posterior wall near the fundus. Good retraction with little hæmorrhage until the patient was being lifted off the table, when profuse bleeding occurred from the vagina. Gasping respirations followed by deep cyanosis. The pulse became weak and death resulted almost immediately.

P M —Left ventricle contracted. Right auricle and ventricle bulging forwards and filled with fluid blood mixed with air to form a fine foam. Left ventricle fluid blood alone.

Busalla's case —

Primigravida aged 32 years. Intraperitoneal cervical Cæsarean section on account of severe bleeding from placenta prævia. Trendelenburg position. The incision involved the placental site and there was considerable hæmorrhage. Infant delivered as a breech. Ergot was given and bleeding was controlled by compression of the uterus. While the uterine incision was being sutured there occurred two gurgling sounds as though air was being sucked in, and the suspicion of embolism was immediately aroused. The patient quickly became cyanosed, the breathing noisy and rattling, the pulse rapid and small. The operation was finished without anaesthesia. After returning to bed the patient's condition rapidly became worse, and she died some twenty to thirty minutes after the first appearances of air embolism.

Fink has also reported an established case of air embolism (section for eclampsia). The air was presumed to have entered through the open mouth of a vessel which was discovered in an imperfectly sutured part of the uterine wound. About Meyer's case some doubt has been expressed as to whether air embolism actually was the cause of death (Kraul).

These four are the only cases reported after 'cervical' section, though Hanley has recently contributed another following a 'low classical' operation for central placenta prævia. Among the factors which have been said to play a part in producing this condition, the following may be noted: uterine atony, Trendelenburg position, massage of the sutured uterus, forcible efforts to express blood at the end of the operation, the involvement of the placental site or large veins in the uterine incision, and the Trendelenburg position plus the presence of placenta prævia.

INVERSION OF THE UTERUS

Once during attempts to remove the placenta by expression and cord traction in a case of severe atony, the uterus suddenly relaxed and became inverted through the lower segment incision. Reduction was not easy.

A WARNING

At a second Cæsarean section Schockaert found a 'cyst' of unusual appearance in the placenta. It proved to be a dab left behind at the first operation.

ACCIDENTS WITH THE UTERINE PACK

Pierce has drawn attention to two of these. First, the pack has been caught up in the first uterine suture and its removal has given rise to difficulty. Secondly, when a shuttle has been used to guide the end of the pack through the cervix this little instrument has been pushed into curious positions. In one instance it was forced through the wall of the uterus, later discovered by means of X rays, and finally removed from the peritoneal cavity—the patient surviving.

TWO PUERPERAL COMPLICATIONS

When suppuration in the lower angle of the wound is associated with a frankly purulent discharge from the vagina a *utero abdominal fistula* probably exists. I have seen this on only one occasion its presence being proved by the escape of the vaginal douche through the abdominal incision. Phaneuf has recorded nine instances of this condition. In one patient subjected later to a second Cæsarean section the uterine scar was found to be perfectly healed. Recovery took place in all cases.

An occurrence to which my attention has twice been drawn is the *extrusion of the uterine suture* in the lochial discharge. Bickenbach and others have recorded similar experiences. It need not necessarily lead to any weakness of the scar as I was able to prove at a subsequent operation in one of my own cases.

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CHAPTER X

AUTHOR'S RESULTS

(246 LOWER SEGMENT OPERATIONS)

"It is a question of taking pains. I once heard a very distinguished surgeon say that no one could continue to operate upon even simple cases such as inguinal hernia without mortality, one or two might die in every hundred. If this view is taken, the practice of the surgeon will justify and sustain it. But if you deal with cases as units and say, 'The last case may yet die, and the next case be a desperate one which no man can save, but this case must not die whatever happens', you will find your practice will go far to vindicate your determined optimism and your confidence" (MOYNIHAN, "Abdominal Operations", 4th ed., 1928, 1, 258)

"In this (Caesarean section), as in every other operation, it is easy to find long series of cases recorded with no maternal mortality, but no matter how skilful the surgeon, if only he performs a sufficient number of any given operation, he will not in the end escape the minimal mortality (BLACKER, "Jour Obst and Gynaecol Brit Emp", xxviii, 448)

"Es hat aber keinen Zweck, Spitzenresultate zu publizieren, das dient wohl dem Renommee des Operateurs, aber nicht der Wissenschaft" (WINTER, "Zentralb f Gynäkol", 1935, 2402)

Of the total number of patients (246) on whom the author has performed this operation, 238 were delivered in the Liverpool Maternity Hospital. The remaining 8 operations were carried out in the following hospitals or nursing homes —

Birkenhead Maternity Hospital (B M H)	4
Saithport Maternity Hospital (S M H)	1
St Helens Maternity Hospital (St H M H)	1
Rodney Nursing Home, Liverpool (R N H)	1
Holmside Nursing Home, Liverpool (H N H)	1

The results are summarized thus —

Operations 246

Mortality and Morbidity.—

Unreduced maternal mortality	0.0 per cent
Unreduced foetal mortality	5.7 per cent
Total morbidity rate	23.5 per cent

Healing of Abdominal Wound.—

Primary	..	..	..	..	195
Secondary—					
Infection involving practically the whole length of the wound	..			2	
Infection involving approximately one-third of the wound	..			3	
Trivial infection	..	..		46	
				—	51

Four operations were concluded by subtotal hysterectomy.

When beginning a series of operations it would be neither wise nor safe for any operator to place too much reliance on the part that good fortune is likely to play in the eventual results. As he looks back, however, it is both instructive and encouraging to see how far fortune has shared in the final shaping of his figures. There were among the author's patients at least 9 who, from such causes as uterine infection, wound infection, spinal anæsthesia, hæmorrhage, and pulmonary embolism, must only narrowly have escaped death. This 'invisible' mortality of 3·6 per cent has been constantly in his mind and its influence will be found reflected in the views expressed throughout the preceding chapters of this work.

Grouping.—The results are presented under five headings:—

I. *Suspect or Infected Group* (70). It is formed mainly of patients with minor or greater degrees of pelvic contraction or disproportion operated on at a time in labour when a satisfactory outcome by the vaginal route could no longer be hoped for.

II. *Placenta Prævia* (43).

III. *Toxæmia, Pre-eclampsia, Eclampsia* (1 case) (18).

IV. *Heart Disease* (14).

V. *Cases of Favcurable Omen*.—A group of patients in most of whom it is generally agreed that the mortality should be infinitesimal (101). These were operated on mainly before labour, or shortly after its onset. Vaginal interference was absent or minimal.

Details of the cases are given in *Tables I-IV*, pp. 196-223.

1. SUSPECT OR INFECTED GROUP (*Table I*)

(70 CASES)

Previous Interference.—In 5 patients attempts had been made to deliver with the forceps. In 15 the operation was performed on

women in whom labour had been induced by surgical methods In 10 more there had been a variety of other manipulations

Fever.—This was present in some degree in 13 patients at the time of operation

Fœtal Mortality (Unreduced).—4·2 per cent

Causes —

Hydrocephalus	1
---------------	---

Intracranial hæmorrhage	1
-------------------------	---

(Face presentation, previous attempts to deliver with forceps, easy abdominal delivery of head)

Symptoms of intracranial damage	1
---------------------------------	---

(Mother in labour more than four days but death more likely due to great difficulty in delivering the head)

Total Morbidity.—30 per cent

Wound Healing.—

Primary	43
---------	----

Secondary	27
-----------	----

Causes of Morbidity.—

Uterine infection	8
-------------------	---

Uterine and wound infection	5
-----------------------------	---

Uterine infection and pyelitis	1
--------------------------------	---

Uterine infection, retrovesical abscess	1
---	---

Uterine and wound infection, pelvic peritonitis	1
---	---

Uterine and wound infection, pyelitis and hydronephrosis	1
--	---

Thrombophlebitis and pulmonary embolism	1
---	---

Herpes labialis and gastro enteritis	1
--------------------------------------	---

Acute bronchitis	1
------------------	---

Unknown	1
---------	---

There were many other patients in whom the lochial discharge was profuse and smelly, but who were not 'morbid' according to the ordinary standard

Delivery of Infant —

Hand alone	36
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Obstetric forceps	20
-------------------	----

Scalp forceps and hand	11
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Extraction of breech	3
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II. PLACENTA PRÆVIA (*Table II*)

(43 CASES—Multigravidæ, 34; Primigravidæ, 9)

Situation of Placenta.—

Mainly anterior wall	..	..	..	12
Mainly posterior wall	.	..	..	27
Lateral aspect of uterus	.	.	..	1
Anterior and posterior (completely central)	..			3

Abnormal Vascular Arrangements on the Front of Lower Segment.—(10 Cases)

Placenta anterior	..	..	..	7
Placenta posterior	.	..	..	3

Delivery of the Infant.—

Scalp forceps and hand	..	..	..	17
Version and extraction	..	..	..	15
Extraction of breech	..	..	..	9
Obstetric forceps	..	..	..	1
Hand alone	..	..	..	1

Delivery of Placenta.—This was removed manually in 12 cases, twice before and ten times after delivery of the child.

Fœtal Results.—

Survived	.	..	..	..	35
Stillborn	.	..	..	..	2

(In one case the fœtus was dead on admission, in the other the period of gestation was less than 28 weeks.)

Died	6
------	----	----	----	----	---

(Weights of infants which died : 7 lb. 7 oz. (hydrocephalus); 5 lb. 12 oz.; 4 lb. 10 oz.; 3 lb. 10 oz.; 3 lb. 2 oz.; 3 lb.)

Fœtal Mortality (unreduced).—18·6 per cent.

Causes of Puerperal Morbidity.—

Uterine infection	..	..	..	5
Thrombophlebitis	..	..	..	3
(Two very mild, one severe, white leg.)				
Unknown	..	..	..	3

Wound infection	2
(The total number of wound infections was 6. They were all slight, though 2 were considered to be the cause of fever in the puerperium.)	
Acute bronchitis	1

Blood Transfusion.—This was given to only one patient in this series. There were a few others to whom it should have been given. Nevertheless the necessity for replacing blood lost will become less and less as the frequency of vaginal interference diminishes.

Blood transfusion on any obstetric indication should be given slowly by the drip method. It should always, if possible, be running during the operative intervention, and its speed made to vary with the actual stages of the operation. Thus in Cæsarean section the drip is continued until the beginning of the uterine incision when the blood is allowed to run freely to replace any loss at this moment. It is then slowed down, quickened again while the placenta is being extruded, and brought back to a drip rate for the remaining stages of the operation. I do not believe that any extremely anæmic woman is killed by blood transfusion, the speed at which it is sometimes given may, however, prove fatal.

The Vaginal Examination.—In 27 patients in whom hæmorrhage was the cause of admission to hospital, the operation was performed on the history alone or the history in conjunction with suspicious abdominal signs. In 25 the diagnosis of placenta prævia was confirmed, in 2 patients not included in *Table II* the bleeding was proved to have been caused by premature separation of the normally implanted placenta.

The vaginal examination is not always conclusive even when the cervix will admit a finger. In one patient in whom the preliminary diagnosis was "accidental hæmorrhage", this was altered after vaginal examination to "central placenta prævia". At operation the placenta was wholly on the upper segment, partially separated from the uterine wall, and a large clot of blood was found overlying the internal os!

III. ALBUMINURIA, PRE-ECLAMPSIA, OR ECLAMPSIA (1 CASE) (*Table III*) (18 CASES)

Anæsthesia.—

Spinal	..	..	..	..	9
Local	..	..	..	..	9

Delivery of Infant.—

Scalp forceps and hand	..	..	..	10
Obstetric forceps	..	..	..	4
Hand alone	..	..	..	2
Extraction of breech	..	..	..	1
Version and extraction	..	..	..	1

One infant (*Case No. 210*) weighing 4 lb. 4 oz. died. The mother was suffering from chronic nephritis and von Recklinghausen's disease.

Causes of Puerperal Morbidity.—

Uterine infection	..	..	..	2
Pyelitis	..	..	..	2
Pyelitis and bronchitis	..	..	..	1
Thrombophlebitis in saphenous vein	..	..	..	1
Unknown	..	..	..	1

Among the patients in *Table III* placenta prævia was discovered in two cases—one being of the central and one of the low lateral variety. These have not been included in *Table II*.

IV. HEART DISEASE (*Table IV*) (14 CASES)

All infants survived. One patient (*Case No. 196*) had a morbid puerperium. This was attributed to slight wound infection.

Delivery of the Infant.—

Scalp forceps and hand	..	..	..	7
Hand alone	..	..	..	5
Obstetric forceps	..	..	..	2

Anæsthesia.—

Local	..	..	..	10
Spinal	..	..	..	4

Sterilization was attempted in all patients. This was unsuccessful in one instance (*see Case Nos. 153 and 244, p. 222*).

V. CASES OF FAVOURABLE OMEN

(101 CASES)

Chief Indications.—

Repeat Caesarean sections	45
Contracted pelvis and/or disproportion ..	30
Obstetric history	16
Accidental antepartum hæmorrhage ..	3
Elderly primigravida (no abnormality) ..	2
For sterilization	1
For umbilical hernia	1
Dermoid cyst in pouch of Douglas ..	1
Asthma	1
Pulmonary tuberculosis	1

Morbidity Rate.—14·8 per cent.

Causes.—

Undetermined	4
Bronchopneumonia and acute dilatation of stomach	1
Bronchitis	1
Pleurisy	1
Uterine infection	3
Wound infection	1
Pyelitis	2
Thrombophlebitis	1
(Very mild, discharged on 19th day.)	
Puerperal insanity	1
(Complete recovery.)	
Wound infections	13
(All trivial and frequently no more than a little serous discharge from the extreme lower end.)	

Fœtal Mortality.—1·9 per cent.

Causes.—1. Atelectasis.

2. Imperforate anus.

Delivery of Infant.—

Scalp forceps and hand	58
Hand alone	18
Obstetric forceps	11
Extraction of breech	7
Version and extraction	7

The hospital registration numbers of the above 101 cases are given below, under their respective years:—

- 1932: 1495, 1436, 760, 1471, 561, 230, 310, 1513, 768, 1530.
 1933: 1260, 1099, 1851, 1649, 1648, 1598, 1740, 1724, 92, 866, 1062, 384, 1053, 700, 1195, 326, 572, 1116, 1562.
 1934: 424, 1609, 98, 136, 333, 1181, 1145, 894, 1139, 1120, 1179, 1344, 1419, 1407, 1554, 1633, 1634, 1829, 1796, 1967, 1973, 2040, 1895.
 1935: 19, 212, 137, 81, 144, 710, 604, 1098, 1362, 1422, 1718, 1886, 46.
 1936: 195, 194, 1951, 694, 844, 1035, 1622, (H.N.H.).
 1937: 371, 977, 1125, 1128, 947, 1413, 1383, 1702.
 1938: 30, 547, 534, 208, 650, 781, 926, 218 (B.M.H.), 1249, 1338, 1373, (St.H.M.H.), 1553, 2142, 1793, 1847, 1229, 448 (B.M.H.), 1797, 1799.

Since the above synopses and the following tables were prepared, the author has performed four lower segment operations in the Liverpool Maternity Hospital. The indications were:—

1. Shoulder presentation. (In Labour seven hours, membranes ruptured six days, tonic contraction of uterus.)
2. Central placenta prævia. (Operation following vaginal diagnosis, and the insertion of vaginal plugging to control the consequent bleeding.)
3. Toxæmia. (Albuminuria, marked œdema, and blood-pressure varying between 180 and 200 mm. Hg.)
4. Contracted pelvis.

The first infant was stillborn and that in the second case died from prematurity. The mothers survived. The patient with the shoulder presentation had a very stormy convalescence, from ileus during the first week, and subsequently from extensive wound suppuration.

NO. OF CASE	DURATION OF LABOUR IN HOURS	TIME ELAPSED SINCE RUPTURE OF MEMBRANES IN HOURS	VAGINAL EXAMINATIONS	DEGREE OF DILATATION OF CERVIX IN FINGERS	OTHER FACTORS SUGGESTING INCREASED RISK OF INFECTION	SPECIAL CONDITIONS PRESENT AT OPERATION	METHOD OF DELIVERY INFANT
1 327 34	29	24	3	3	Tube induction of labour	—	Manual
2 34 34	55	Membranes intact	2	2-3	—	Thin and ballooned lower segment	Extraction breech w extended legs
3 76 34	34	24	2	3	Bougie induction of labour	Considerable amount of free fluid in peritoneal cavity	Manual
4 108 34	13-20	13-30	2	3	—	—	Extraction breech w extended leg
6 157 34	10	0-45	2	Fully dilated	—	Great ballooning of lower segment	Scalp force and hand
7 1847 33	16	17	2	2	—	—	Extraction breech
8 1866 33	46	46	1	3 Thick and oedematous	Bougie induction of labour	Thick poorly formed lower segment	Manual
9 1735 33	29	20	2	Fully dilated for 4 hours	Tube induction of labour	Paper-thin lower segment	Obstetric forceps
10 142 34	15	72	2	3 Thick cervix	—	—	Manual
12 1252 33	24	Unknown	0	Fully dilated 4 hours	—	Very thin lower segment	Manual
15 440 33	Not in labour	5	1	2	Prolapscd cord lying outside vulva for 1½ hours	—	Manual
17 1422 32	131	131	3	Fully dilated	Attempts to deliver with forceps failed after manual rotation	—	Manual
19 1355/32	32	33	2	2	—	—	Manual

OR INFECTED GROUP

DELIVERY OF PLACENTA	WEIGHT OF INFANT lb oz	RESULT TO CHILD L SURVIVED SB STILL BORN D DIED	PLEURISIA		DAYS IN HOSPITAL	REMARKS
			CAUSE OF MORBIDITY	WOUND HEALING		
Expression	7 12	L	Not morbid	Primary	17	—
Expression	7 5	L	Not morbid	Slight infection lower end	18	Marked hour glass uterus—the only instance in which the condition was met with the membranes still intact
Expression	6 11	L	Not morbid	Discharge of pus from lower end	16	Anterior parietal bone presentation Secondary uterine inertia
Expression	8 9	L	Not morbid	Primary	19	—
Manual removal	6 3	L	Not morbid	Slight infection lower end	24	Marked hour glass uterus (Fig 102 p 178) presentation <i>positio occipitalis publica</i>
Expression	7 10	L	Not morbid	Primary healing	16	—
Expression	6 6	L	Rigors pyelitis and uterine infection	Infection lower end	20	—
Expression	8 12	I	Uterine and wound infection	Infection lower end	17	Marked hour glass contraction of uterus
Expression	7 14	L	Not morbid	Primary healing	20	—
Manual separation of placenta	7 9	L	Not morbid	Primary healing	53	Labour obstructed by ovarian dermoid weighing 13 oz
Expression	6 4	L	Not morbid	Primary healing	25	—
Expression	6 4	I	Uterine and wound infection	Infection lower end	29	Generally contracted pelvis Persistent occipito posterior position
Expression	6 8	L	Not morbid	Primary healing	16	—

Table I.—SUSP

NO OF CASE	DURATION OF LABOUR IN HOURS	TIME ELAPSED SINCE RUPTURE OF MEMBRANES IN HOURS	VAGINAL EXAMINATIONS	DEGREE OF DILATATION OF CERVIX IN FINGERS	OTHER FACTORS SUGGESTING INCREASED RISK OF INFECTION	SPECIAL CONDITIONS PRESENT AT OPERATION	METHOD OF DELIVERY
20 1310/32	44	5	2	—	Tube induction of labour	—	Manual
21 356/34	33	32	3	3	Tube induction of labour	—	Scalp and forceps
24 510/34	81	54	4	Fully dilated	—	Great ballooning of lower segment	Obstet forceps
25 983/33	8	1	2	2	Cord prolapsed during vaginal examination	—	Manual
28 880/32	33	24	4	3	T.99 6', P.130	Extensive adhesions from previous classical section	Obstet forceps
30 428/32	36	5	4	4	—	—	Obstet forceps
29 1443/32	43	46	5	3	—	—	One hand obstet forceps
31 1633/32	43	51	3	3-4	—	—	Manual
37 1712/33	12	2	3	Three-quarters dilated	Tube induction of labour T.98', P.124	Great thinning of lower segment	Scalp and forceps
38 1444/33	Not in labour	72	—	1	Foetid liquor and meconium being discharged	—	Manual
39 1715/33	39	39	3	Fully dilated	—	Constriction ring	Obstet forceps
53 243/33	32	14	6	Fully dilated	Attempts to deliver with forceps failed	—	Obstet forceps
61 953/33	28	23	2	3	Tube induction of labour	—	Scalp and forceps
62 1042/33	28	56	7	Fully dilated	—	Paper-thin lower segment	Obstet forceps

INFECTED GROUP—*continued*

DELIVERY OF PLACENTA	WEIGHT OF INFANT lb oz	RESULT TO CHILD L. SURVIVED S.B. STILL BORN D. DIED	PUERPERIUM		DAYS IN HOSPITAL	REMARKS
			CAUSE OF MORBIDITY	WOUND HEALING		
Expression	6 8	L	Herpes labialis and gastro enteritis	Infection lower end	22	Signs of foetal distress
Manual	8 10	L	Repeated pulmonary emboli White leg	Infection and breaking down of lower third	47	—
Expression	6 14	L	Not morbid	Infection lower end Slight thrombo phlebitis left leg	24	Marked hour glass contraction of uterus
Expression	9 4	L	Not morbid	Primary healing	19	—
Expression	6 10	L	Not morbid	Primary healing	15	—
Expression	6 8	L	Uterine infection Wound infection In fected hydro nephrosis	Infection lower end	33	Temperature subsided on ureteric catheter drainage of right kidney
Manual	8 0	L	Not morbid	Primary healing	13	—
Expression	6 9	L	Retrovesical abscess	Primary healing	40	Abscess drained above Poupart's ligament (p 122)
Expression	9 1	L	Not morbid	Primary healing	17	Hour glass contraction of uterus Posterior parietal bone presentation
Manual separation	7 4	L	Acute bronchitis	Superficial serous blebs	54	—
Expression	6 13	L	Not morbid	Primary healing	19	—
Expression	9 1	L	Not morbid	Primary healing	27	Drainage of abdominal wound
Expression	6 8	L	Not morbid	Slight infection lower end	23	—
Expression	8 6	L	Not morbid	Primary healing	19	—

NO OF CASE	DURATION OF LABOUR IN HOURS	TIME ELAPSED SINCE RUPTURE OF MEMBRANES IN HOURS	VAGINAL EXAMINATION	DEGREE OF DILATATION OF CERVIX IN FINGERS	OTHER FACTORS SUGGESTING INCREASED RISK OF INFECTION	SPECIAL CONDITIONS PRESENT AT OPERATION	METHOD OF DELIVERY OF INFANT
64 770/32	52	5	1	3	Bougie induction of labour	—	Manual
66 1841/32	41	20	1	Half dilated	Attempts to deliver with forceps failed	—	Obstetric forceps
67 742/32	26	4	3	4	—	—	Manual
70 15/34	20	50	7	Three-quarters dilated	Putrescent liquor	—	Manual
73 150/34	43	45	4	3 Thick oedematous cervix	Bougie induction of labour (twice)	—	Scalp forceps and hand
76 909/32	93	Unknown	8	3	—	—	Obstetric forceps
78 1492/32	22	22	3	Fully dilated	Examination under anaesthesia. T.99-6°, P.100	—	Manual
74 342/32	52	Unknown	1	3	T.100, P.100	—	Manual
79 812/32	35	26	2	2	hydrostatic bag inserted. Cervix failed to dilate after 24 hours	Moderate hydrocephalus. Perforation before extraction	Scalp forceps and hand
83 965/34	24	20	3	2	Intrapartum infection and rigors. T.103°. Tube induction of labour. Tube in uterus 72 hours	Constriction ring	Scalp forceps and hand
84 946/34	15	16	3	Fully dilated	—	Bladder high and segment very thin	Manual
90 925/34	24	Membranes intact	2	2	—	—	Scalp forceps and hand
92 1017/34	14	14	2	2	—	—	Manual
94 1480/34	47	28	3	Three-quarters dilated	T.101-6°, P.136	Great thinning and ballooning of lower segment	Obstetric forceps

INFECTED GROUP—continued

DELIVERY OF PLACENTA	WEIGHT OF INFANT lb oz	RESULT TO CHILD	PUERPERIUM		DAYS IN HOSPITAL	REMARK
		L. SURVIVED SB STILL BORN D. DIED	CAUSE OF MORBIDITY	WOUND HEALING		
Expression	6 10	L.	Not morbid	Primary healing	15	—
Manual separation	8 2	L.	Not morbid	Slight infection lower end	29	Uterine atony Shock In travenous gum saline
Expression	6 15	L.	Not morbid	Primary healing	19	—
Expression	8 15	L.	Not morbid	Primary healing	13	—
Expression	8 5	L.	Not morbid	Primary healing	15	Severe post partum hemorrhage one hour later
Expression	6 4	L.	Not morbid	Primary healing	14	—
Manual separation	6 12	L.	Not morbid	Primary healing	15	—
Manual separation	8 0	L.	Not morbid	Primary healing	14	—
Expression	6 14	SB	Not morbid	Primary healing	18	—
Expression	6 12	L.	Suppuration and separation lower half of wound Pelvic peritonitis Uterine infection	Extensive wound infection	57	See p 123
Expression	7 7	L.	Not morbid	Primary healing	17	—
Expression	7 13	L.	Not morbid	Primary healing	19	—
Expression	7 6½	L.	Not morbid	Primary healing	18	—
Expression	7 13	L.	Not morbid	Infection lower end	23	Hour glass uterus Lower segment distended with foul smelling purulent liquor and gas

Table I.—SUSPECT OR

NO. OF CASE	DURATION OF LABOUR IN HOURS	TIME ELAPSED SINCE RUPTURE OF MEMBRANES IN HOURS	VAGINAL EXAMINATIONS	DEGREE OF DILATATION OF CERVIX IN FINGERS	OTHER FACTORS SUGGESTING INCREASED RISK OF INFECTION	SPECIAL CONDITIONS PRESENT AT OPERATION	METHOD OF DELIVERY OF INFANT
108 923/34	28	6	2	Fully dilated	Membranes artificially ruptured at full dilatation	Lower segment thin and tensely distended with liquor	Obstetric forceps
116 5/35	7	39	1	Unknown	T.99°, P.112. Foul-smelling discharge of liquor and meconium	—	Manual
122 43/35	Not in labour	—	—	—	Insertion of bougies failed to bring on labour	—	Scalp forceps and hand
125 463/35	28	21	4	3 Thick	Examination under anaesthesia and replacement of prolapsed hand	Constriction ring	Scalp forceps and hand
127 362/35	31	14	6	Three-quarters dilated	—	Lower segment very thin	Manual
135 1173/35	32	9	2	Half dilated	Tube induction of labour T.101.8°, P.120	—	Obstetric forceps
230 1934/38	25	Unknown	1	3			Obstetric forceps
223 1023/38	45	24	5	Nearly fully dilated		Bladder very high	Obstetric forceps
215 459/38	44	59	—	Three-quarters dilated	P.114	Lower segment unusually thick	Manual (forceps slipped)
214 429/38	71.30	Unknown	3	—	T.100.2°, P.104	Very marked constriction ring	Manual
211 105/38	21	6	2	Fully dilated	T.100°, P.104	Marked constriction ring. Purulent and foul-smelling liquor	Manual
150 155/36	6	100	1	2	16.7.36, attempted rupture of membranes to induce labour. 17.2.36, successful rupture of membranes. 21.2.36, Cæsarean section. During previous days temperature varying between 100.2° and 101.4°. Smelly vaginal discharge	—	Manual

INFECTED GROUP—continued

IN VENTRY OF PLACENTA	WEIGHT OF INFANT	RESULT TO CHILD L. SURVIVED S.B. STILL BORN D. DIED	EXPERIMENT		DAY IN HOSPITAL	REMARKS
			CAUSE OF MORBIDITY	WOUND HEALING		
Expression	6 1	L	Not morbid	Primary healing	17	Hour glass uterus
Expression	7 1	L	Not morbid	Slight infection lower end	18	Infant's ear cut with scissors during incision of uterus
Expression	8 12	L	Uterine infection	Infection lower end	20	
Expression	9 15	L	Uterine infection	Primary healing	19	Marked degree of hour glass uterus. Lower flap extremely thin and torn during extraction of the head
Expression	7 0	L	Not morbid	Infection lower end	20	Deep frontoparietal depression on infant's head
Expression	6 8	L	Uterine infection	Primary healing	16	
Manual separation	5 10	L	Not morbid	Primary healing	16	
Expression	5 13	L	Uterine infection	Slight infection lower end	19	
Expression	7 13	L	Uterine infection	Primary healing	19	
Expression	8 3	L	Uterine infection Pychitis	Slight infection lower end	19	Typical hour glass uterus
Expression	9 12	L	Uterine and wound infection	Infection lower end	21	Hour glass uterus (see Fig 99 p 176)
Expression	7 1	L	Uterine infection	Primary healing	20	Post operative ileus

NO OF CASE	DURATION OF LABOUR IN HOURS	TIME ELAPSED SINCE RUPTURE OF MEMBRANES IN HOURS	VAGINAL EXAMINATION	DEGREE OF DILATATION OF CERVIX IN FINGER-	OTHER FACTORS SUGGESTING INCREASED RISK OF INFECTION	SPECIAL CONDITIONS PRESENT AT OPERATION	METHOD OF DELIVERY OF INFANT
233 1446 38	25	14	2	Three-quarters dilated	Examination under anaesthesia. Version considered but found impossible on account of constriction ring	Lower segment extremely thin	Obstetric forceps
137 1322 33	21	6	1	Unknown	—	—	Manual
140 1037 33	Not in labour	101	—	—	Induction by tube failed owing to bleeding which was aroused, membranes therefore ruptured instead. Pains did not ensue and foul vaginal discharge was accompanied by rises in temperature	—	Manual
180 37 S.M.H.	30	—	1	—	Gentle attempt to deliver with forceps failed	Marked constriction ring	Manual
171 299 37	59	22	9	Nearly fully dilated	—	—	Manual
161 1226 36	80	Unknown	3	Three-quarters dilated	Face presentation. Attempts to deliver with forceps failed after manual dilatation of cervix	Putrescent liquor and meconium	Manual (easy)
163 36 R.N.H.	48	72	2	Half dilated	—	—	Manual
169 1048 37	22	34	1	2	—	—	Manual
154 841 36	15	22	1	Unknown	T 100, P 120	—	Obstetric forceps
185 243 37	56	Unknown	3	Fully dilated	T 100	Considerable free fluid in peritoneal cavity	Manual
218 133 35	105	105	7	3	—	Marked constriction ring	Forceps
147 93 36	23	24	1	3	T 99, P 100. Smelly liquor	—	Manual
228 1303 38	22	37	1	3	—	—	Obstetric forceps

INFECTED GROUP—continued

DELIVERY OF PLACENTA	WEIGHT OF INFANT		RESULT TO CHILD I SURVIVED II STILL BORN D DIED	PLEURISY		DAYS IN HOSPITAL	REMARKS
	lb	oz		CAUSE OF MORBIDITY	WORKED HEALING		
Expression	10	6	I	Cause unknown	Primary healing	22	Hour glass uterus. Slight hysterectomy (see Fig 14 and Plate I p 37)
Expression	9	0	I	Not marked	Primary healing	20	Hour glass uterus. Small pulmonary embolus
Expression	6	7	I	Uterine and wound infection	Infection lower end	23	Lower uterine flap split during extraction of head
Expression	7	11	I	Not marked	Slight infection lower end	16	Hour glass uterus
Expression	8	10	I	Not marked	Primary	12	Differrentiation operation concluded by total hysterectomy (see Fig 20 p 121)
Expression	8	9	D	Uterine infection and extensive suppuration in wound	Infection whole length	39	
Expression	10	6	I	Uterine infection	Infection lower end	17	
Expression	7	8	I	Not marked	Primary	18	
Expression	6	14	Lo	Not marked	Exposure back of	16	
Expression	7	11	I	Not marked	Primary	21	
Expression	6	1	D 3rd day	Not marked	Infection lower end	27	
Expression	6	1	Lo	Not marked	Primary	18	
Expression	7	8	I	Not marked	Primary	14	

INFECTED GROUP—continued

DELIVERY OF PLACENTA	WEIGHT OF INFANT lb. oz.	RESULT TO CHILD L. SURVIVED S.B. STILL BORN DIED	PLEURISY		DAYS SINCE BIRTH	REMARKS
			CAUSE OF MORBIDITY	WOUND HEALING		
Expression	5 13	I	Yes	Slight infection lower end	0	Bluish glass uterus
Expression	7 4	I	Uterine infection	Infection lower end	27	
Expression	7 4	L.	No	Primary	18	Peristent deep laceration
Expression	6 14	L.	No	Primary	17	Continuous slight swelling of 3 hours following introduction. Not much tenderness. At operation little was found to be curled up behind placenta

Table II.—

No of Case	AGE	GRAVIDA	HISTORY OF BLEEDING, ETC.	GENERAL CONDITION	VAGINAL EXAMINA- TIONS		PRESENTATION	DIAGNOSIS
					*B.A.	*A.A.		
206 500 37	42	P	Small loss 2 days before admission. The following morning blood was found directed into left iliac fossa.	Good	—	—	Vertex	History and abdominal
204 752 37	27	3	Bleeding with passage of clots night before admission. Persistent small losses during ensuing 12 days. By now there was a frankly offensive blood-stained vaginal discharge.	Mitral stenosis	—	—	Breech. External version performed.	History and abdominal
201 1700 37	35	8	Warning loss 7 days earlier. Bright hæmorrhage with clots immediately before admission.	Fair	—	—	Head high, mobile, and indistinctly felt.	History and abdominal
227 073 38	41	2	Passed a large clot of blood 2 days before admission. Two days later a small blood-stained discharge was present.	Good	—	—	Large baby with head not engaged.	History
164 1529 36	32	3	One small loss followed by a considerable bleeding 2 weeks later at 26th week. No further hæmorrhage. Operation 64 days later.	Good	—	—	During waiting period head repeatedly found directed into left iliac fossa.	History and abdominal
177 602 37	22	1	Warning show 14 days before bright loss which demanded admission.	Fair	2	—	Vertex	History
184 064 37	36	1	Bright hæmorrhage before admission.	Fair	3	—	Breech, lying obliquely.	History and abdominal
162 1443 36	36	9	Severe loss before admission.	Fair. Mitral stenosis.	1	—	Breech	History and abdominal

*B.A., Before admission;

PLACENTA PRÆVIA

INCISION OF UTERUS	METHOD OF DELIVERY	PLACENTAL INSERTION	INFANT		CAUSE OF MORBIDITY	REMARKS
			WEIGHT lb oz	RE- SULT		
Blunt incision (see Fig 88 p 161)	Scalp forceps	Posterior and central	5 11	L	Not morbid	Local anaesthesia
Blunt incision	Version	Posterior and partially covering in- ternal os	4 8	L	Not morbid	Local anaesthesia
Blunt incision	Version	Anterior and apparently covering the os	6 12	L	Not morbid	Local anaesthesia Placenta in line of incision and deliver- ed before the infant
Blunt incision	Scalp forceps	Posterior and reaching to margin of os	9 4	L	Not morbid	Local anaesthesia
Vertical incision extended with fingers in order to avoid large veins on front of lower seg- ment	Version	Anterior and central	5 14	L	Not morbid	Spinal anaesthesia Placenta torn through with fingers Double flap closure of uterovesical peri- toneum
Blunt incision Very large veins on front of lower segment	Scalp forceps	Central	5 3	L	Severe bron- chitis	Spinal anaesthesia
Foot secured and incision extended trans- versely while drawing on leg	Extraction as breech	Posterior and central	6 11	L	Not morbid	Local anaesthesia
Foot secured through small incision which was enlarged transversely while drawing out leg and thigh	Extraction	Anterior	3 0	D	Not morbid	Local anaesthesia Left uterine artery narrowly escaped division Steriliza- tion

Table II.—PLACENTA

No of Case	AGE	GRAVIDA	HISTORY OF BLEEDING, ETC	GENERAL CONDITION	VAGINAL EXAMINATIONS		PRESENTATION	DIAGNOSIS
					*B.A.	*A.A.		
178 825/37	26	P.	Three small losses with clots during preceding 10 days	Good	—	—	Vertex (oblique)	History and abdominal
225 908/38	35	1	Losing off and on for 4 hours before admission	Good	1	—	Vertex, high	History and abdominal
213 413/38	44	6	Small losses off and on for 8 weeks. Brisk loss night before admission	Fair	1	—	Head lying towards left iliac fossa	History and abdominal
208 26/38	37	5	Two losses before admission. Slight bleeding during succeeding 3 days	Good	1	—	Head lying in right iliac fossa	History and abdominal
80 1018/34	43	8	Attempt to induce labour with tube failed. Patient began to bleed and pass clots	Good	—	1	Transverse chiefly	History and abdominal
148 197/36	25	2	Considerable loss immediately before admission	Poor. Air-hunger	2	—	Breech	History and abdominal
132 728/35	28	1	Several small losses over some days before admission	Good	—	—	Small fully flexed foetus. Head high and could not be pressed into brim	History and abdominal
195 1315/37	39	5	First 'show' 5 days before. Moderate loss just before admission	Fair	—	—	Foetus lying obliquely. Hæmorrhage resulted from attempts to press head into brim	History and abdominal

* B.A., Before admission;

PRÆVIA—continued

INCISION OF UTERUS	METHOD OF DELIVERY	PLACENTAL INSERTION	INFANT		CAUSE OF MORBIDITY	REMARKS
			WEIGHT lb oz	RE SULT		
Blunt incision	Scalp forceps	Anterior and reaching to margin of os	6 0	L	Four days No signs of uterine infection	Local anaesthesia Wound reopened under ether to look for swab which had not been left behind Slight infection of lower end of wound
Blunt incision Large thin walled veins on front of lower segment Placenta swept aside and foot secured	Version	Anterior and central	8 0	L	Uterine infection	Local anaesthesia
Blunt incision	Scalp forceps	Posterior and high lateral	5 6	L	Uterine infection	Local anaesthesia plus a little ether
Blunt incision without rupturing membranes	Scalp and obstetric forceps	Posterior and low lateral	7 7	D	Not morbid	Local anaesthesia Wound broke down in the middle over an extent of $1\frac{1}{2}$ in Infant hydrocephalus and spina bifida Lower segment temporarily picked on account of bleeding
Knife and scissors Large varices on front of lower segment	Version	Anterior and low lateral Manual removal	8 1	L	Uterine infection	Spinal anaesthesia Placenta involved in uterine incision
Knife and scissors	Extraction	Posterior and central	5 12	D	Not morbid	Local anaesthesia
Knife and scissors	Scalp forceps	Mainly on the left lateral aspect of lower segment and reaching to margin of os	4 10	D	Not morbid	Local anaesthesia Incision involved placenta on the left
Blunt incision	Version	Anterior and central Placenta removed before child	4 10	L	Not morbid	Local anaesthesia Lower segment picked on account of atony

A A. After admission

Table II.—PLACENTA

NO OF CASE	AGE	GRAVIDA	HISTORY OF BLEEDING ETC	GENERAL CONDITION	VAGINAL EXAMINA TIONS		PRESENTATION	DIAGNOSIS
					*B A	*A A		
123 124 35	27	P	Several losses over 3 weeks Brisk loss before admission	Fair	I	—	Vertex, hand's- breadth above symphysis	History and abdominal
199 1446 37	27	3	Four 'shows' in pre- vious 14 days Bleeding with clots before admission	Good	—	—	Premature foetus high in uterus. Bleeding aroused by abdominal palpation	History and abdominal
121 146 33	23	1 (SB)	One large loss just before admission	Fair	—	—	Unstable foetus. Head high above brim	History and abdominal
187 1028 37	29	1	Two slight losses, and one considerable bleeding just before admission	Fair	—	—	Transverse	History and abdominal
183 957 37	30	1	Two losses before ad- mission	Fair	—	—	Vertex. Head in left iliac fossa	History and abdominal
176 472 37	31	5	Considerable loss be- fore admission	Poor	—	—	Vertex	History
167 1772 36	28	2	Numerous small losses over one month Slight losses for 6 days after admission	Good	—	—	Vertex	History
129 563 35	33	P	Steady loss for 2 hours before admission	Good	—	I	Vertex	Vaginal
151 289/36	30	P	Losing slightly upon admission Vaginal examination caused further bleeding	Good	—	I	Vertex	Vaginal

* B.A. Before admission.

Table II.—PLACENTA

NO OF CASE	AGE	GRAVIDA	HISTORY OF BLEEDING ETC	GENERAL CONDITION	VAGINAL EXAMINATIONS		PRESENTATION	DIAGNOSIS
					*B.A.	*A.A.		
155 884	36 36	3	High head admitted for induction of labour. Membranes ruptured premature. Vaginal examination revealed low lateral placenta prævia and caused considerable bleeding	Good	1	—	Breech	Vaginal
86 881	37 34	3	One warning loss. Severe hæmorrhage 5 days after admission	Fair	1	1	Vertex. Head in left iliac fossa	Vaginal
91 1128	28 34	P	Bougie induction for apparent disproportion caused severe bleeding. Placenta prævia then discovered	Good	—	1	Vertex high	Vaginal
18 1600	39 32	3	Two losses before admission	Fair	1	1	Vertex	Vaginal
23 531	39 34	1	One bleeding	Fair	1	1	Breech oblique	Vaginal
35 970	43 32	3	Two losses before admission	Fair	1	1	Vertex. (External podalic version before opening abdomen)	Vaginal
157 809/36	33 36	3	Small losses for 3 months. Vaginal examination in another hospital revealed central placenta prævia	Good	1	—	Breech	Vaginal

* B.A., Before admission;

Table II.—PLACENTA

No OF CASE	AGE	GRAVIDA	HISTORY OF BLEEDING ETC	GENERAL CONDITION	VAGINAL EXAMINA TIONS		PRESENTATION	DIAGNOSIS
					*B.A.	*A.A.		
102 1696 34	38	2	Bleeding with onset of labour. Central placenta prævia discovered at another hospital. Vagina packed and patient transferred.	Fair	1	—	Breech	Vaginal
120 416 35	40	2	Intrapartum bleeding. Cervix found 3 fingers dilated. Cord prolapsed and a large piece of placenta projecting into vagina. Large, hard, and mobile fetal head. No fetal heart-sounds.	Fair	2	1	Vertex	Vaginal
120 151 35	43	10	Two losses with clots in previous few weeks. One heavy loss necessitating admission.	Fair	1	1	Vertex	Vaginal
58 1147 33	28	P.	One bleeding.	Good	—	1	Vertex	Vaginal
60 1129 33	26	P.	One loss.	Good	1	2	Breech	Vaginal
54 348 32	33	P.	Intrapartum hæmorrhage found to be due to placenta prævia.	Good	—	2	Oblique	Vaginal
182 954 37	31	1	One loss necessitating admission.	Good	—	1	Breech	Vaginal
179 816 37	39	2	Two Cæsarean sections for contracted pelvis.	Good	—	—	Transverse	Suspected
190 1057 37	38	1	One Cæsarean section and myometomy.	Good	—	—	Transverse	Suspected

* B.A., Before admission;

Table II.—PLACENTA

No OF CASE	AGE	GRAVIDA	HISTORY OF BLEEDING, ETC	GENERAL CONDITION	VAGINAL EXAMINA TIONS		PRESENTATION	DIAGNOSIS
					*B A	*A A		
102 1696/34	38	2	Bleeding with onset of labour. Central placenta prævia discovered at another hospital. Vagina packed and patient transferred	Fair	1	—	Breech	Vaginal
126 416/35	40	2	Intrapartum bleeding. Cervix found 3 fingers dilated. Cord prolapsed and a large piece of placenta projecting into vagina. Large, hard, and mobile fetal head. No fetal heart-sounds	Fair	2	1	Vertex	Vaginal
120 151/35	43	10	Two losses with clots to previous few weeks. One heavy loss necessitating admission	Fair	1	1	Vertex	Vaginal
58 1117/33	28	P	One bleeding	Good	—	1	Vertex	Vaginal
60 1129/33	26	P	One loss	Good	1	2	Breech	Vaginal
54 348/32	33	P.	Intrapartum hæmorrhage found to be due to placenta prævia	Good	—	2	Oblique	Vaginal
182 954/37	31	1	One loss necessitating admission	Good	—	1	Breech	Vaginal
179 816/37	39	2	Two Cæsarean sections for contracted pelvis	Good	—	—	Transverse	Suspected
190 1087/37	38	1	One Cæsarean section and myomectomy	Good	—	—	Transverse	Suspected

* B A, Before admission.

PRÆVIA—continued

INCISION OF UTERUS	METHOD OF DELIVERY	PLACENTAL INSERTION	INFANT		CAUSE OF MORBIDITY	REMARKS
			WEIGHT lb oz	RE SULT		
Vertical incision in lower segment and foot secured. Incision extended down into internal os while drawing on leg	Extraction	Posterior and central	6 4	L	Not morbid	Spinal anaesthesia
Knife and scissors	Scalp forceps	Posterior and low lateral	9 1	SB	Morbid Offensive lochia	Local anaesthesia
Knife and scissors. Placenta partially separated and pushed aside	Version	Anterior and central	6 1	L	Not morbid	Local anaesthesia Profuse offensive lochia slight infection lower end
Knife and scissors	Scalp forceps	Posterior and high lateral	5 8	L	Six days Offensive lochia	General anaesthesia
Knife and scissors	Extraction	Posterior and reaching to margin of os	6 13	L	Not morbid	Spinal anaesthesia
Knife and scissors	Version Shoulder prolapsed into uterine wound and made version very difficult	Posterior and central Manual removal	5 2	L	Not morbid	Spinal anaesthesia Infection lower end of wound
Blunt incision. Enlarged veins on front of lower segment	Extraction Placenta partially torn. Foot secured and incision enlarged by birth of child itself	Anterior and central	5 4	L	Wound infection	Local anaesthesia
Knife and scissors	Extraction	Anterior and posterior and central	7 5	L	Not morbid	Spinal anaesthesia
Blunt incision	Version	Anterior and high lateral	8 10	L	Not morbid	Local anaesthesia Placenta involved in uterine incision

Table II.—PLACENTA

NO OF CASE	AGE	GRAVIDA	HISTORY OF BLEEDING, ETC.	GENERAL CONDITION	VAGINAL EXAMINA TIONS		PRESENTATION	DIAGNOSIS
					B A.*	A A.*		
209 36 38	35	1 (died)	Albuminuria and high blood-pressure and oedema of legs. Bleeding with onset of labour. Low lateral placenta prævia discovered on vaginal examination.	Fair	—	1	Vertex	History and abdominal
246 2401 39	37	2	Slight loss of blood 5 days before admission. Further loss some hours after vaginal examination which had not decided the diagnosis.	Good	—	1	Head occasionally found in right iliac fossa	History and abdominal

* B.A., Before admission;

PRÆVIA—continued

INCISION OF UTERUS	METHOD OF DELIVERY	PLACENTAL INSERTION	INFANT		CAUSE OF MORBIDITY	REMARKS
			WEIGHT lb oz	RE SULT		
Blunt incision without ruptur- ing mem- branes	Manual delivery	Posterior and low lateral	3 10	D	Dry pleurisy 2 small pul- monary em- bolus White leg	Local anæsthesia
Blunt incision Lower segment abnormally vascular	Version	Anterior posterior and central	6 5	L	White leg	Local anæsthesia

A.A. After admission

No. OF CASE	AGE	OBSTETRIC HISTORY	CHIEF SYMPTOMS AND SIGNS ON ADMISSION						HIGHEST BLOOD-PRESSURE
			ALBUMINURIA	CASTS	BLOOD IN URINE %	ŒDEMA	HEAD-ACHE	EYE-SIGHT	
101 1642 34	40	One abortion, one macerated	Trace	—	—	Legs	—	—	110
125 525 35	32	P	2	—	—	Back, abdominal wall, and legs	—	—	160
134 1098 35	32	P	2	—	—	Abdominal wall and legs	—	—	145
141 1779 35	30	P	—	—	3 ⁺	Face, feet, and hands	—	—	150
130 1042 35	35	2	2	—	—	—	—	—	165
184 1104 36	33	P	0.5	—	—	Generalized	—	—	156
160 1042 36	25	P	2.5	—	42	Legs	—	Spots	150
172 302 37	25	Albuminuria in first pregnancy, living child	3	—	—	Generalized	—	—	175
174 503 37	33	Three abortions	2	—	—	Generalized	—	Blurring	155
162 947 37	20	One premature stillborn. Albuminuria	3	—	30	Abdomen and legs	—	—	155
202 1730 37	27	Two normal	2.5	—	—	—	—	—	150
200 1604 37	24	One	7	—	30	Face, abdominal wall, and legs	—	—	165
164 1633 35	35	Four	3	—	—	Generalized	—	Spots	210
194 1233 37	20	One	10	—	25	Face and legs	—	—	170
110 245 38	21	P.	4	—	42	—	—	—	150
236 1175 38	4	Two normal, one stillborn	—	—	30	—	—	—	215
243 1804 35	21	One (C.S.)	1.5	—	25	—	—	—	145
181	29	One	1	—	25	—	—	—	160

ECLAMPSIA OR ECLAMPSIA (1 case)

DAYS IN HOSPITAL BEFORE DELIVERY	ANESTHESIA	CAUSE OF MORBIDITY	WEIGHT OF INFANT		DAYS IN HOSPITAL AFTER OPERATION	REMARKS
			lb	oz		
7	Spinal	Pyelitis	6	4	18	Pus cells and <i>B. coli</i> present in the urine before operation
1	Spinal	Not morbid	7	0	17	Breech with extended legs Membranes ruptured 12 hours before operation Not in labour
2	Local	Not morbid	6	9	15	Vomiting for some days before admission Acetonuria +
1	Spinal	Pyelitis bronchitis	5	5	41	Loss of vision developed shortly before operation Eclamptic fit occurred immediately after giving the spinal injection Low lateral placenta praevia
60	Spinal	Not morbid	6	3	17	Pyelitis Sterilization
1	Spinal	Not morbid	8	8	16	Pus cells and coliform organisms present in the urine Membranes ruptured 14 hours before operation Not in labour
24	Local	Thrombophlebitis in saphenous vein	7	4	15	Bicornuate uterus Severe shock and collapse following castor oil 48 hours after delivery Blood transfusion given
4	Spinal	Not morbid	5	4	25	Sterilization Slight wound infection
-	Spinal	Not morbid	8	4	14	Symptoms and signs of very sudden onset
40	Spinal	? Uterine infection	4	13	24	Albumin rose to 8 g on the day of operation Severe uterine hemorrhage on 12th day of the puerperium Uterine cavity lightly explored with blunt curette
	Local	Not morbid	6	10	32	Breast abscess Slight separation of wound edges
2	Local	Not morbid	6	3	19	Contracted pelvis Section repeated in 1938
1	Local	Pyelitis	7	14	18	Sterilization
2	Local	Uterine infection	7	3	22	Cesarean section repeated in 1938 (See No 243 below)
30	Local	? Cause	4	4	17	Chronic nephritis Sterilization Was also suffering from von Recklinghausen's disease Infant died
52	Local	Not morbid	6	12	17	Central placenta praevia present Headaches dizziness and hyperpiesia
32	Local	Not morbid	6	6	19	Refused sterilization (See No 194 above)
8	Spinal	Not morbid	6	13	18	Considerable accidental hemorrhage 8 days after admission

Table IV.—

NO OF CASE	AGE	GRAVIDA	TYPE OF HEART LESION	CHIEF SYMPTOMS OR SIGNS	PREVIOUS HISTORY
14 1180/33	21	1	Mitral stenosis	Dyspnoea	Rheumatic fever, aged 15
27 1737/33	25	2	Mitral stenosis	Dyspnoea Mitral facies. Persistent tachycardia. Heart enlarged	—
48 1131/33	33	4	Mitral stenosis	Breathlessness and palpi- tation	Scarlet fever, aged 14
51 137/33	38	1	Mitral stenosis	Palpitation. Shortness of breath on exertion. Albuminuria	Rheumatic fever
22 436/31	34	4	Cardiac enlargement Systolic apical and aortic murmurs	Precordial pain Oedema legs and ankles. Hæmo- globin, 34 per cent R B C 2,752,000	Rheumatic fever, aged 3½
119 214/35	22	1	Mitral stenosis and aortic regurgitation	Tachycardia. Palpita- tion	Rheumatic fever, aged 18
133 894/36	22	1	Mitral stenosis	Dyspnoea	Rheumatic fever, aged 12
170 117/37	43	4	Mitral stenosis and regurgitation	Dyspnoea Palpitation Oedema of ankles	Rheumatic fever, aged 17 and 19
174 351/37	24	2	Mitral stenosis	Dyspnoea on exertion. Palpitation Slight cyanosis of lips. Al- buminuria	Repeated attacks of ton- sillitis
186 958/37	27	3	Mitral stenosis	Dyspnoea. Palpitation	Scarlet and rheumatic fevers when a child
196 1317/37	28	3	Mitral stenosis	Dyspnoea, on exertion	—
230 1801/37	31	4	Mitral stenosis and auricular fibrilla- tion	Shortness of breath. Cough Palpitation	Rheumatic fever, aged 15
244 1986/38	26	2	Mitral stenosis	Dyspnoea	Rheumatic fever, aged 12
245 2122/39	39	3	Mitral stenosis and auricular fibrilla- tion	Breathlessness	Rheumatic fever, aged 6

HEART DISEASE

DAYS IN HOSPITAL BEFORE OPERATION	ANESTHESIA	METHOD OF DELIVERY	DAYS IN HOSPITAL AFTER DELIVERY	WEIGHT OF INFANT lb oz	REMARKS
45	Local	Manual	21	6 6	Sterilization
14	Spinal	Scalp forceps and hand	23	8 9	Sterilization
5	Spinal	Manual	24	6 9	Sterilization
11	Spinal	Manual	24	5 12	Sterilization
26	Spinal	Scalp forceps and hand	14	7 5	Sterilization Abdominal distension and vomiting 24 hours after delivery
60	Local	Scalp forceps and hand	24	5 8	Sterilization Pulse rate rose to 140 shortly after onset of labour Serous discharge from lower end of wound
8	Local	Scalp forceps and hand	18	6 8	Sterilized by section and ligation of tubes ends not buried A second pregnancy occurred in 1938 (See No 744 below)
81	Local	Manual	14	6 2	Sterilization
51	Local	Scalp forceps and hands	16	6 2	Sterilization Though patient was not in labour there was a deep groove between corpus and lower segment Slight serous discharge lower end of wound
18	Local	Scalp forceps and hand	17	6 5	Sterilization
4	Local	Manual	24	7 12	Sterilization Slight wound infection
40	Local	Scalp forceps and hand	18	7 0	Sterilization
32	Local	Obstetric forceps	22	7 6	Uterine stump of left tube found to be patent Sterilization performed (See No 153 above)
47	Local	Obstetric forceps	31	6 11	Sterilization

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